GENERAL LIBRARY,
UNIV. OF MICH.
SEP 13 1899

THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JULY 13, 1899. CHICAGO, ILL. NUMBER 28

The only reasons that higher prices are being constantly paid by the most prominent steam users in the United States for Cahall Boilers are—that they are better made, last longer, cost less for maintenance, show a higher efficiency and make drier steam than any other kind.

Send for illustrated catalogue.

Cahall Sales Department, Pittsburg, Pa.

THE HARRINGTON & KING PERFORATING CO. CHICAGO.

METALS PERFORATED AS REQUIRED FOR SCREENS OF ALL KINDS.

Main Office and Works: 226 N. Union St., Chicago.

HONEST BABBITT METALS.

We do not claim that we are supplying ten different governments with Babbitt Metal. Our Metals are used by more than three thousand leading Consumers in UNCLE SAM'S own country. They are invariably uniform, reliable, contain only pure and best material, remarkably fluid, and free from "drossing."

PRICES TO ALL—XXX Nickel Babbitt 24 cts. per lb.; No. 2 Grade (for general shop use), 10 cts. per lb.; F. O. B. your depot, on your customary terms. Any special mixture of metal made to order. 3,000 References.

SWARTS METAL REFINING CO., Office and Works, 20 N. Desplaines St., Chicago, Ill.

ENTERPRISE BOILER COMPANY Draught Stacks, Blast Furnaces and Heavy Plate Work a Specialty

YOUNGSTOWN, O. Write for Estimates.

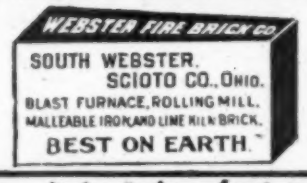
POWER TRANSMISSION

W. A. JONES FOUNDRY & MACHINE CO.

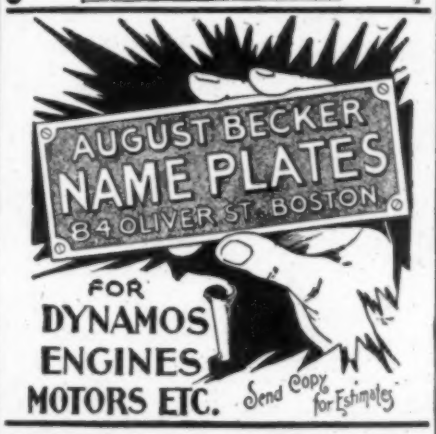
53-59 So. JEFFERSON ST. CHICAGO

..Fire Brick..

Ground Clay A SPECIALTY.



Special Shapes.



TURNBUCKLES.

Cleveland City Forge & Iron Co., CLEVELAND, O.

The A B C of Iron, Now $1.

THE UNION BOILER TUBE CLEANER CO.
231 Penn Ave., PITTSBURGH, PA.

Has set the acknowledged standard for the world for removing—by power driven mechanical devices—all conditions of scale from all makes of Water Tube Boilers—curved as well as straight tubes—also from pipes and tubes used in industrial enterprises. We have the only Flexible Shaft of Remarkable Strength and Phenomenal Durability under Great Stress.

See large Advertisement of

B. F. STURTEVANT CO., Boston, Mass.

On Page 25.

BLOWERS, FANS, ENGINES.

W. S. ROCKWELL & CO.,

OIL FURNACES.

26 Cortlandt St., New York City.

CHAMPION CUTTING-OFF TOOL.

Will save its cost in 30 days.

Made by WESTERN MFG. CO., Springfield, O.

Blakeslee Steam Jet Pump.

REASONS FOR ITS USE:

1. Simplicity. 2. Is independent of engine. 3. Will pump sandy or impure water. 4. Have no valves and no wear. 5. Not subject to freezing. 6. Economy and reliability. 7. All parts interchangeable. Write

BLAKESLEE MFG. CO., Du Quoin, Ill.

FORSTER, WATERBURY & CO.,
Malleable and Grav Iron Castings.
..LINK BELT..
1200-1, No. 355 Dearborn Street
CHICAGO, ILL.

THE CHICAGO SCREW CO.

A NEW TOOL! Made in seven sizes.

MANUFACTURED ONLY BY
Armstrong Bros. Tool Co., 106 W. Wash. St., Chicago, Ill.

If a sheet, or part of a sheet, of galvanized iron has any defect, send it back at jobber's or our expense—the same as when business is slow.

Apollo Iron and Steel Company, Pittsburg.

The Bourne-Fuller Co.,
DISTRIBUTORS OF
APOLLO PRODUCTS.
Cleveland, O.

The Chemical Analysis of Iron, $4.00.

BRISTOL'S
RECORDING INSTRUMENTS
For Pressure, Temperature and Electricity.

All ranges, Low Prices and fully guaranteed.

Send for Circulars and Specimen Charts.

The Bristol Co., Waterbury, Conn.

WORKS, SHARON. MINES, CLEARFIELD CO., PA.

James V. Rose,
.....PROPRIETOR.....

SHARON FIRE BRICK WORKS,

Contractor in Fire Brick Construction.
Manufacturer of High Grade Fire Brick.

ANALYSIS:

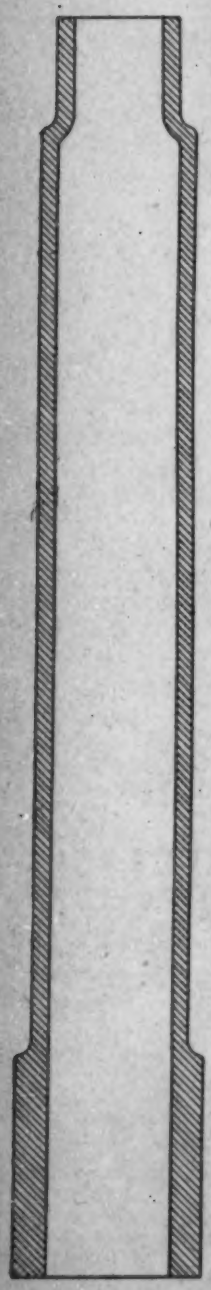
Brick.		Red Clay.	
Silica	54.50	Silica	47.00
Alumina	44.20	Alumina	39.00
Loss on Ign.	.05	Loss on Ign.	13.20
Iron	.15	Iron	.13

SHARON, PA.

Tin Mills F. R. Phillips' Sons Co.
See page 42.

THE UPSON NUT CO., Cleveland, O.
MANUFACTURERS OF
MACHINE AND CARRIAGE BOLTS, HOT FORGED AND COLD PUNCHED NUTS, LAG SCREWS, BOLT ENDS, WASHERS, ETC. Catalogue and Prices on Application.

SHELBY STEEL TUBE CO.,
Seamless Locomotive Flues.
CLEVELAND, O.
NEW YORK, 144 Chambers St. CHICAGO, 135 Lake Street.
BIRMINGHAM, ENGLAND, 29 Constitution Hill.



Riveted Steel Pipe, Stand Pipes, Receivers.

The WM. B. POLLOCK CO.
with inquiry please give ad. No. 6.
YOUNGSTOWN, O.

Blast Furnaces, Steel Plants, Boilers, Tanks, etc.

H. B. Rusch & Co.
COMMERCIAL PAPER.
200 LaSalle St.,
Chicago, Ill.

MALLEABLE CASTINGS.
High Tensile Strength.
BIKE STEEL CASTINGS.
Will Not Harden in Brazing.
CARBONIZED BIKE STEEL CASTINGS,
Will Temper Like Tool Steel.
ACME MALLEABLE IRON WORKS.
Buffalo, N. Y.

The Iron Founder

A comprehensive treatise on the art of molding, including chapters on core making, loam, dry sand and green sand molding, also crystallization, shrinkage and contraction of cast iron and a full explanation of the science of pressures in molds, added to which are formulas for mixtures of iron, tables, rules and miscellaneous information. By Simpson Bolland. Illustrated with over 300 engravings. 12mo.; cloth $2.50

Sent, postpaid, on receipt of price, by
The Iron Trade Review Co.,
Chicago. Cleveland. Pittsburg

AULTMAN

We have an engineering department competent to treat any question in the equipment of factories with money saving methods and appliances.

Write us, Catalogue "C" on application.

THE AULTMAN COMPANY,
908 South Market St., Canton, Ohio, U. S. A.

12 Standard Types AIR COMPRESSORS with a large number of Special Patterns.
Covering the requirements of every application of compressed air. Each machine equipped with the most improved accessories relating to the economical production of compressed air. Send for new catalogue.
Rock Drills, Stone Channelers. | **THE Ingersoll-Sergeant Drill Co.,** Cleveland, New York. | Coal Cutters. The Pohle Air Lift Pumps.

The Bourne-Fuller Co.,
IRON, STEEL
AND
PIG IRON.
Cleveland, - Ohio.

H. A. STREETER'S
PATENT STEEL CLIP
Saves half the Expense. For connecting Angles, Tees or Bars to I Beams for Roofs, Ceilings and other Iron and Steel Constructional Work. Does away with Drilling and Bolting.
Structural Iron Work a Specialty.
H. A. STREETER,
35 TO 41 INDIANA STREET, - - CHICAGO.
Mention this paper.

THE IRON MASTERS' LABORATORY, Established 1866.
J. Blodget Britton & Co., Analytical and Consulting Chemists,
Warrenton, Virginia, formerly located 339 Walnut Street, Philadelphia.
Analyses of Iron Ore, Iron, Steel, Coal and Coke, Slag, Limestone, Clay, Fire Brick, Water, etc.

RAND DRILL AND ROCK DRILLS AND AIR COMPRESSORS
DRILL MOUNTINGS.
All Sizes.
Standard Types.
Special Patterns.
Highest Degree of Perfection.
Long Experience.
Recognized Leaders.
RAND DRILL CO.
100 Broadway, NEW YORK.
Monadnock Block, CHICAGO.

AIR COMPRESSORS
For every application of Compressed Air Power.
Complete Catalogue upon application.
Clayton Air Compressor Wks.
26 Cortlandt St., NEW YORK.

Cable Address "METALFAC-CHICAGO" A B C Code
E. H. STROUD & CO.,
METAL FACTORS.
The Products of and Supplies for
IRON · STEEL · TIN-PLATE · BRASS
COPPER · LEAD · & · ZINC · WORKS.
36 La Salle Street *100 William Street*
CHICAGO. NEW YORK.

THE ROBERT W. HUNT & CO.,
Bureau of Inspection, Tests and Consultation.
PITTSBURG: Park Building. CHICAGO: 1137 The Rookery. NEW YORK: 71 Broadway.
Reports on iron and steel processes and plants. Inspection of steel rails, splice bars, railroad cars, wheels, axles, etc. Chemical Laboratory—Analysis of ores, iron, steel, oils, water, etc. Physical Laboratory—Test of metals, drop and pulling test of couplers, draw bars, etc. Efficiency tests of boilers, engines and locomotives.

O. TEXTOR,
Chemist, Metallurgist and Assayer.
Analyses made of Metals, Ores, Fuels and Supplies for Furnaces, Steel Works and Foundries.
Ores sampled at mines, furnaces and lake ports.
Advice furnished to operators of Blast Furnaces Steel Works and Foundries.
Mining properties reported upon.
158 Superior St. CLEVELAND, O.

F. A. EMMERTON.
Analytical Chemist,
AND METALLURGIST.
Ores sampled at lake ports, mines and furnaces.
Mines and Metallurgical Processes examined.
Analyses made of Ores, Metals, Fuels, Railroad and Foundry Supplies, etc.
9 Bratenahl Building, CLEVELAND, O.

John T. Jones & Co.,
Mines, Prospects, Explorations and Mineral Lands, examined, experted, practical tests made and reported. Reliable and practical sampling done. Chemical analysis made. All work done by practical expert. Best of reference as to experience and reliability. Address
Suite 32, 115 Monroe St.,
Montauk Block, CHICAGO, ILLS.

A B C OF IRON,
NOW $1.00.

Millett's Patent
CORE OVEN.
The best in the world.
MILLETT CORE OVEN CO., Brightwood, Mass.

DICKMAN & MACKENZIE,
CHICAGO,
1234 Rookery Building.
Mining properties examined. Ores sampled at mines, furnaces and all lake ports.
General analyses of Ores, Slags, Metals, Fuel, Foundry Materials and Products, etc.
CHEMISTS AND ENGINEERS.

Subscribe for the Iron Trade Review.

THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JULY 13, 1899. CHICAGO, ILL. NUMBER 28

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Indications already appear that the course of the iron market in the second half of the year will be marked by events quite as significant as any that have gone into the history of the first six months. Every week is adding to the amount of business on furnace order books for 1900, and in the next six months the basis of a large part of the finished material tonnage for next year will be determined from month to month. The trade is coming to the conclusion that the period of good profits in iron and steel is to be of longer duration than any prophet of three months ago would have dared to predict. The restoration of the equilibrium between production and consumption is not nearly so definitely talked of now as in early spring. Labor troubles and a persistent labor scarcity in primary lines of production keep deferring the much predicted turn. The great strain upon important sources of supply is seen in the fact that last week's stoppages at Central Western steel works and the relief they have had by reason of the shut down of tin plate works, with their weekly consumption of over 8,000 tons of sheet bars, has left steel plants no better off than before. The shut down of Sharpsville furnaces, now nearly two weeks long, has cut off nearly 15,000 tons of metal, largely Bessemer. Furnaces are dropping behind in shipments, and it is evident already that a portion of the iron, Bessemer and non-Bessemer, that has been sold for 1899 delivery will not go from the furnaces until 1900. The same condition obtains in finished material, and really the only question in this connection is how far the unfulfilled business of this year will lap over into the next. There were more furnaces in blast July 1, with larger production, than on June 1; yet consumption has evidently continued to grow. Those who expected that the new furnaces would overtake consumption of pig iron by the middle of the year, figured that consumption would either stand still or recede in the face of high prices. It has done neither; and until some means of gauging its course can be discovered, predictions based on statistics of production and stocks will be of little value. In pig iron, the purchases of the past week have been in large part for 1900. Buyers are willing to pay current prices, which have touched $20 valley for No. 2 foundry, and sellers are willing to accept them; but at the rate they have sold in the past month some are fully booked for from 50 to 75 per cent of their output for the first half, allowing nothing for the postponed deliveries that are now a certainty. The situation is thus perplexing. Bessemer iron is squarely on a $20 basis valley furnace, and the associated furnaces will make the first sales for delivery up to July 1, 1900, at that figure. Steel works and furnace companies alike count on a shortage of Bessemer iron in the coming six months. Laetst advices from Sharpsville are that the furnace workers' strike is at an end, the men returning to work on the old basis. The advances of the week have been from 50 cents to $1 on pig iron, $5 a ton on structural material and $3 a ton on hoops and bands. Beams and channels are now $2 Pittsburg and mills are unable to make deliveries short of fall. The signs of lessened buying due to advancing prices are still deferred. Bessemer steel is so scarce, with no prospect of any addition to output, except by the new plant at Mingo Junction, O., that high level prices for steel products will rule for months to come. The new open-hearth plant at Birmingham, Ala., is expected to be ready in September, and the first sale of billets is of 15,000 tons for delivery in the Pittsburg district. To keep the new plant going will take from the market quite the equivalent of any increased production of foundry and forge iron through the starting of additional Alabama furnaces.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.*
705 PUBLICATION BUILDING, July 12

Evidences are multiplying that the second half of the year in the iron trade will be still more interesting than the first half. The scarcity of steel is growing more pronounced and there are strong probabilities that steel mills will have serious difficulties in the next month or two in the way of securing an adequate supply of iron. So far there has been some difficulty, but the necessary shut downs of steel mills in the beginning of the month made the iron supply go farther than it otherwise would.

Transaction during the week have been of small volume, but the general strength of the market has been sufficient to raise prices notwithstanding. In the cruder lines price are generally somewhat higher. Finished material is holding its own well, and in structural an advance of a straight $5 a ton, or a quarter of a cent a pound, was made last week. When business opens up again after the usual mid-year slackening the effect is likely to run down from finished product clear to the raw material and send up the general level of prices to points not heretofore reached this year, and scarcely dreamd of. The situation is not likely to be relieved before the end of September, but during the last quarter there may be a breathing spell.

PIG IRON.—The six furnaces at Sharpsville banked the beginning of the month resumed to-day, the men going back at old terms. The loss in production at Sharpsville since the banking commenced amounts to fully 15,000 tons, chiefly Bessemer, which was due at Youngstown and Pittsburg. There is no Bessemer pig offered before the first of the year. The price is nominally $20, valley, or $20.75, Pittsburg, and a search would probably bring out some iron, but not much. Interest in the market centers on production rather than the possibility of sales. Gray forge is stronger in Pittsburg, and has sold up to $17.50, the price remaining in the valleys at $17 as quoted last week. Foundry irons are all quite scarce, and No. 2 has sold as high as $19.25, delivered Pittsburg, and although this price might be shaded a fair amount, there is little to be had at any price. The situation

is very strong in all grades of pig iron. We quote prices as follows:

Bessemer, valley furnace	$20.00
Bessemer, Pittsburg	20 75
No. 1 Foundry	19.50 to $20.00
No. 2 Foundry	19 00 to 19.25
No. 3 Foundry	18 50 to 18.75
Gray Forge, valley furnace	17 00 to 17 25
Gray Forge, Pittsburg	17.40 to 17 50

STEEL.—Transactions in billets during the week have been of no moment. A round lot of sheet bars was sold at $33, mill. The steel supply is very much cut up, and deliveries of billets are an unknown quantity. The shut down of the tin mills has not relieved the situation in sheet bars, but on the contrary the difficulties of the steel mills have prevented the sheet mills even from getting their usual demands, so that the tin plate tie-up is a welcome relief to all but the tin plate interest. The New Castle mill has been off since the first of the month, and will not have repairs completed until the end of the week, but is expected to be put on Monday next. The pig iron supply of this mill is not likely to be interfered with. Mingo and Bellaire have been running the past week, but under difficulties on account of the shortage of pig iron already noted; and at Youngstown, where operations are resumed, there is considerable trouble, as much of the Sharpsville iron was due there. If the furnace labor trouble extends further steel production will be very seriously interfered with. The situation is a strained one outside of the valley labor difficulty, and cannot be relieved until about the end of the third qurater, when one new furnace at Pittsburg and the second of the Lorain stacks are likely to have been completed and put in blast. The new furnaces at Youngstown are not likely to be ready for blast this year. We quote billets very scarce at $33.50 to $34, and only to be had from mills in the smallest lots.

FERRO MANGANESE.—Domestic ferro continues to be quoted at $85 for 80 per cent in large lots and higher prices for smaller quantities.

RAILS AND TRACK MATERIAL.—There is nothing doing in the rail market and quotations remain at $20 to $3 for standard sections, according to tonnage. It is not at all likely that any considerable tonnage would be booked at these or any other figures. The new mill at Youngstown, while not far from completion, is not expected to do much this year, as the market in rails is not so inviting as other lines. Track material is firm at former figures: Spikes, 2.2c to 2.30c; track bolts, 2.65c to 2.75c; splice bars, 1.75c to 1.90c; links and pins, 2.15c to 2.25c.

BARS.—There is no change to be noted in this line, both steel and iron bars being very firm. Steel bars are quoted at 2c to 2.25c, with iron bars about a dollar a ton lower.

STRUCTURAL MATERIAL.—A further advance was made by the associated producers last week, of $5 a ton, or a quarter of a cent a pound, making prices as follows: Beams and channels, 3 to 15 inches, 2c; 18 to 24 inches, 2.10c; tees, 2.05c; zees, 2 05c; angles, 2c. Universal mill plates remain at 2.35c a pound. The large mill being set up at Homestead may be put in operation this month.

PLATES.—The plate market is very firm and fancy prices are being paid for spot or early delivery. The market is not quotable except for delivery the latter part of the year, as premiums of half a cent a pound or even more are being paid for early delivery. We quote for late deliveries prices unchanged as follows: Tank, 2.40c; shell, 2.50c; flange, 2.65c; fire box, 3½c to 4c.

PIPES AND TUBES.—The National Tube Co. has taken formal possession of the mills, but the selling end of the business remains without any formal change. The directors are meeting to-day in New York and a number of details in regard to selling policy, etc., are likely to be arranged. The market is very firm, and orders can scarcely be booked at all for deliveries within three months. Some of the mills are entirely out of the market except for later deliveries. We quote prices unchanged as follows: Merchant pipe, base discount, 50 per cent and additional discounts two 10's for less than carloads and two 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casting, 40 for screw and socket joint and 35 for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 40 per cent; 1¾ to 2½-inch, 50 for iron and 55 for steel; 2¾ to 6-inch, 55 for iron and 57½ for steel; extra 5 percent to dealers.

SHEETS.—The sheet mills are very much hampered on account of inability to get sufficient supplies of sheet bars. The bulk of the mills are in operation again after the shut down, but are not in all cases up to their proper output. Prices are about as last quoted, 2.95c to 3c for No. 28 common. A few of the mills are entirely out of the market and others are quoting fancy prices. Galvanized is stronger. The leading local mill advanced its quotation yesterday to 70 and 5 per cent off, and 70 and 7½ is the best that can possibly be done. With the advance in spelter these quotations are fully justified, and if spelter goes higher, as is expected in many quarters, still higher prices for galvnaized may certainly be looked for.

SPELTER.—This metal has shaken off its weakness and has advanced sharply, until it is now held at 5.90c, St. Louis, and 6.10c, Pittsburg. There is some talk that the metal may go to 8 cents, but there can be nothing predicated definitely even as to which way the market will tend.

OLD MATERIAL.—The market for scrap iron and steel is very much cut up. A fair business is doing, but in most grades material is scarce and prices cover a wide range. We quote the market about as follows: New melting stock, $17; old steel rails, mixed lengths, $16.50 to $17; cut, $17; old iron rails, $21 to $22; wrought iron scrap, $17 to $18; cast borings, $9 to $9.50, net, Pittsburg; busheling scrap, $12.50 to $13. net; car wheels, $17.50, gross; cast scrap, $16.50 to $17, gross; wrought turnings, $11, net, Pittsburg.

COKE.—The coke market is very firm. Production is going on this month at about the same rate as last. The shipments of the leading interest amounted in June to 31,256 cars, which is a trifle under the best former daily average, but still the shipments have been abnormally lrge. Some difficulty is experienced in getting cars. We quote Standard Connellsville coke at $2.25 for furnace and $2.15 to dealers and $2.30 to consumer for crushed and foundry.

CHICAGO.

Office of The Iron Trade Review and Industrial World.
1522 MONADNOCK BLOCK, July 12.

The relief that may have been anticipated from the closing of the consuming plants during the opening days of July, has not materialized to any appreciable degree. There is less activity in the sale of products, but shipments from mill do not seem to be made with greater facility than in June. The advance of structural material $5 a ton and of hoops and bands $3 a ton late last week are but indices of the prevailing condition in all departments. Buyers are shunning producers all their business will permit, and sellers are giving their customers no encouragement to hope for an early improvement in the tightened condition of trade. The sellers in fact are doing as much of the avoidance act as are the buyers. It is an armed truce, both parties waiting for a change in the general situation, which both realize is beyond their control. There is a little buying for immediate needs. For the ensuing six months little business is being transacted. For the early months of 1899 trading has a slightly better volume, but the nature of that buying is naturally more or less speculative.

PIG IRON.—One of the annoying facts of the present trade

is that furnaces which have either lately gone into blast or expect to start in the near future, have oversold their product. Delays have occurred in getting the furnaces in operation and some of the furnacemen find they have contracted to deliver product beyond their capacities, owing to these delays. Some buyers who have thus engaged material have found it necessary to duplicate their orders elsewhere. The new inquiry that is on the market is quite large in the aggregate and the condition of the furnaces is such that this added buying is not readily provided for. The silveries and No. 1 foundry are very scarce and not a few consumers of those grades have been compelled recently to devise new mixtures in view of the scarcity. The agricultural implement foundries and a number of miscellaneous users have closed down for inventory and repairs and the extreme stringency of the market has thereby been temporarily modified, but there does not seem to be any essential improvement in the situation. The large producers are heavily sold into the future and are as strong in their quotations as ever. A little new iron has come into the market from the Northwest, it is said, at a slight concession from current quotations, but that product must soon be absorbed by the trade, if indeed it is not already taken at this writing. Southern iron is higher. As thus modified, quotations are as follows:

Lake Sup. Charcoal	$21 00 @ $23 00	Southern Coke No. 3	$17 90 @ $18 65
Local Coke Fdy. No. 1	19 00 @ 20 00	Southern No. 1 Soft	18 90 @ 19 65
Local Coke Fdy. No. 2	18 50 @ 19 50	Southern No. 2 Soft	18 40 @ 19 15
Local Coke Fdy. No. 3	18 00 @ 19 00	Southern Silveries	18 50 @ 19 00
Local Scotch Fdy. No. 1	19 00 @ 20 00	Jackson Co. Silveries	22 50 @ 23 00
Local Scotch Fdy. No. 2	18 50 @ 19 50	Ohio Strong Softeners	20 00 @ 21 00
Local Scotch Fdy. No. 3	18 00 @ 19 00	Alabama Car Wheel	19 50 @ 20 00
Southern Coke No. 1	18 90 @ 19 65	Malleable Bessemer	20 00 @ 21 00
Southern Coke No. 2	18 40 @ 19 15	Coke Bessemer	20 00 @ 21 00

BARS.—The bar trade is without new feature. There is a good running demand, of a volume sufficient to absorb the producing capacity of the mills. The markets in the East are relatively higher than those at Chicago and the Western territory, and the pressure upon prices appears to be from below. Iron bars are quoted 1.85c to 1.90c and steel bars from 2c to 2.20c.

STRUCTURAL MATERIAL.—An advance of $5 per ton was made in the price of all shapes on Friday last week. When the previous advance of $5 was made a checking of demand was anticipated by some factors to the trade. But the country kept right on buying material. This advance is having a similar reception. The past week has been one of unusual activity. One transaction involved 10,000 tons of railroad bridge material and 1,000 tons were sold for local buildings. Small trade was in volume quite large. Quotations follow: Beams, 15 inches and under, 2.15c to 2.20c; 18 inches and over, 2.25c to 2.35c; angles under three inches and over six inches, 2.25c to 2.35c; three inches to six inches, 2.15 to 2.25c; sheared plates, 2.85c to 3c; universal plate, 2.75c; tees, 2.20c to 2.30c; zees, 2.20c to 2.30c; small lots from store are quoted from ¼c to ⅓c higher.

PLATES.—Conditions have not changed. The mills are buried deep under their obligations and store prices are very strong. It has become impossible for consumers to obtain all the material their wants require. Tank steel from store is quoted 3c to 3.20c. Mill shipments, Chicago delivery, are as follows: Tank steel, 2.75c; shell, 2.85c; flange, 2.95c; marine, 2.95c; fire box, 3c to 5c, according to brand.

MERCHANT PIPE.—Makers are sold far into the future and early deliveries are impossible on new trade. Steel pipe is stronger and is now quoted 50, 10 and 5 per cent. Quick shipments command a premium over that discount.

SHEETS.—The closing of the mills last week has left the trade in a waiting condition. There has been little business transacted, but prices are without change and are as follows: No. 27 black, 3c to 3.10c; galvanized, 70 and 10 from mill and 70 from store.

MERCHANT STEEL.—Small transactions in merchant steel have been numerous during the past week and the range of values is undisturbed by additional advances. Smooth finish tire steel is quoted 2.45c to 2.50c; smooth finish machinery steel, 2.70c to 2.75c; spring steel, 3.20c to 3.30c; tool steel, 6c to 7.50c; special, 10c and upwards.

BILLETS AND RODS.—The market is without life, as sellers are not active. Small sales of Bessemer billets have been made on a basis of $33, and sheet bars at $35. Rods are nominally $42.

RAILS AND TRACK SUPPLIES.—There continue to present themselves a large number of inquiries for standard rails, but the market is inactive on account of the inability of makers to respond to the demand. Standard rails are quoted $30 to $32; light rails, $32 to $37. Splice bars are 1.70c to 1.75c; spikes, 2.25c to 2.35c; track bolts, 2.85c to 3.25c.

OLD MATERIAL.—The higher products of the scrap pile are the favorites and command rising prices. There is some irregularity in the market but the general tone is strong. We quote as follows:

Old iron rails, gross	$18 00@$18 50	Axles, net	$19 00@$20 00
Old steel rails, long, gr.	15 00@ 15 50	Cast borings, net	6 50@ 7 00
Old steel rails, mixed	14 50@ 15 00	Wrought turnings, net	7 50@ 8 00
Old wheels, gross	15 50@ 16 00	Axle turnings, net	8 25@ 8 75
Railroad forge, net	15 50@ 16 50	Mixed steel, gross	10 50@11 00
Dealer's forge, net	12 00@ 12 50	Stove plates, net	7 50@ 8 00
No. 1 mill, net	9 00@ 9 25	Heavy melting steel, gr	13 00@14 00
Heavy cast, net	12 00@ 12 50	Old iron splice b., net	17 00@18 00
Malleable cast, net	8 50@ 9 00		

WIRE AND WIRE NAILS.—Values are without change and a fair trade is reported, though buying has been somewhat checked by the stocking up of intermediate sellers a few days ago. Wire nails are quoted at $2.60 f. o. b. Chicago, in car lots, and $2.70 less than car lots. On wire current quotations are as follows: Plain annealed wire, $2.45; painted barb wire, $2.70; galvanized barb wire, $3.20.

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.*
27 VINCENT ST., July 12.

Little is heard now of the possibilities of re-sales of ore by purchasers who had bought more than their probable requirements. The advance of $1 and $1.25 a ton has been an inducement, but furnacemen have had to reckon lately with the probability of not getting all the ore they contracted for and therefore must regard any over purchases as only proper margins of safety. Exploratory and development work and the re-opening of old properties by new owners are still the features of operations in the Lake Superior region. The Menominee and Marquette ranges are the scene of most of the resumption work at properties supposed to be closed for all time or at least until the exhaustion of the choicer properties; but ore operations are like blast furnace operations—the minor and less fit properties are being worked along with the best. The activity of exploration work at a time when well-known mines are short of labor is to be accounted for by the preference shown by workmen for camp life to the systematic operations at mines long worked. Much of the new work now in progress is therefore calculated rather to lessen this year's production. At most mines the scarcity of tramming labor is very noticeable. In the past week little has been done in the way of wild charters. The rates to-day are 90, 80 and 75 cents, respectively, from Duluth, Marquette and Escanaba. A brisker grain movement from Chicago has made the Escanaba rate very firm.

PIG IRON.—Inquiries are being made for Bessemer iron for delivery in 1900, and some is reported sold, though not by association furnaces. The price fixed by the latter at the last meeting is $20 valley, for delivery up to July 1, 1900, though there is a strong sentiment among some of the furnacemen against fixing a price at present, and particularly in the absence of definite inquiries from consuming interests. It is not probable that more than 50,000 tons of association iron could be bought now on the $20 basis for delivery in the first and second quarters of 1900. It is evident that the price for delivery this year will go higher, though very little iron could be had, and that from second hands and from one or two outside furnaces; and there are those who look for a higher price for Bessemer in the first half of next year. The strike at Sharpsville has kept six furnaces closed since July 1, and a production of 12,000 to 15,000 tons has been lost already. Furnaces were behind on deliveries before the strike came, and no little inconvenience will result, particularly to foundries depending on Sharpsville irons. The demand of the strikers is for an advance from $1.80 to $2 a day for turn work, and from $1.50 to $1.65 for common labor. An effort has been made, without success thus far, to get out the men at Sharon and West Middlesex furnaces. In the past week further sales of foundry iron have been made in this market and $19 has been the basis for No. 2 in most cases, with an advancing tendency. For delivery in the first half of 1900 prices vary. Business has been done at $19 to $20, valley, a round lot having been closed at the latter figure. Very little iron

can be had for delivery in the last quarter of this year and practically none for the third quarter. We quote f. o. b. Cleveland:

Bessemer	$20 75	Valley Scotch No. 1	$19 75@20 75
No. 1 Strong Foundry	19 75@20 75	Valley Scotch No. 2	18 75@19 75
No. 2 Strong Foundry	18 75@19 75	Gray Forge, valley	17 00@17 50
No. 3 Foundry	17 75@18 75	Lake Superior Charcoal	21 00@22 00

Advices from Sharpsville are that the furnace strike ended Wednesday morning, the men returning to work at the old wages.

FINISHED MATERIAL.—The demand upon mills and jobbers is incessant. For early shipment the jobbers get most of it, consumers having found it useless to go to the mills with such orders. In consequence the margin between mill prices and store prices is widening, all the way from $3 to $10 a ton above the usual difference being paid. The advance of $5 a ton made in structural material at the close of last week puts beams and channels at 2c, Pittsburg, but delivery short of early fall is almost beyond the question. Angles in particular, and especially the smaller sizes, are scarce, and 2.50c has been paid in some cases. Hoops and bands have advanced $3 a ton in the week. Bar iron at valley mill is 1.80c, and 2c is still the basis on sales from store, Cleveland. On steel bars 2.50c is paid for material out of stock. In the week inquiries have come from agricultural implement manufacturers who usually contract for bars, sheets, plates and machinery steel at this season. A six months' supply is asked for in some cases, deliveries beginning in the fall. But in some lines mills are well sold to Jan. 1, particularly in bars. We continue to quote No. 27 black sheets at 3.30c out of stock, Cleveland, and galvanized at 70 off. Heavy sheets are scarce and good premiums are paid for early delivery. For plates 3c can be had for tank where prompt delivery is possible.

WIRE AND WIRE NAILS.—In the Cleveland and Pittsburg districts repairs are still in progress at some of the plants. Demand is well maintained. For wire it is greater than the mills had counted on. There is no change in prices. Net cash in 30 days are now strict terms, though jobbers are giving 60 days. We quote: Wire nails, $2.35, Pittsburg, in carload lots to jobbers; smooth wire, $2.20 to jobbers in carload lots; painted barb wire, $2.45; galvanized, $2.95.

CINCINNATI.

July 11.

The market has not yet shown any influence of hot weather upon it. Usually by this time there is a decided let up in inquiry, but this is not a usual year in any way at all and the demand is as heavy and as steady as ever. There is still a heavy inquiry for deliveries during the first six months of next year, and most of the large transactions are for this delivery. There is a fine scattering demand for soft foundry metal for shipment during the next three or four months, and it is this trade that is puzzling the furnaces and selling agents. They find it easy enough to sell iron into next year because the furnace capacity for that time has not yet been filled. It is almost impossible, however, to get soft iron for any reasonably prompt shipment. It seems strange but a great majority of the furnaces in the South have had trouble of late in making soft iron. There has been an unusual quantity of mill iron made, so that this, together with the increased demand, has made foundry iron particularly scarce. Quite a large proportion of the orders booked the past week were for deliveries the first half of 1900. Many buyers entertain the belief that current figures are to be sustained for a long time to come, and to insure provision for reasonable necessities are covering for those requirements. Coke is following in the wake of pig iron and prices are advancing accordingly in the various districts. The figures below represent approximately prices current, for cash f. o. b. Cincinnati: Southern coke No. 1 foundry, $18.50 to $18.75; Southern coke, No. 2 foundry, $17.75 to $18.00; Southern coke, No. 3 foundry, $16.50 to $16.75; Southern coke, No 4 and gray forge, $15.75 to $16; Southern coke, mottled, $15.75 to $16; Southern coke, No. 1, soft, $18.50 to $18.75; Southern coke, No. 2, soft, $17.75 to $18; Lake Superior coke, No. 1, $19 to $19.50; Lake Superior coke, No. 2, $18.50 to $19; Hanging Rock charcoal, No. 1, $21 to $22; Jackson county silvery, No. 1, $23 to $24; Standard Georgia car wheel, $18.75 to $19.50; Lake Superior charcoal, $21.50 to $22.50.

Advance in Prices of Castings.

Further letters from foundrymen are given below relative to the advance in prices of castings due to the rapid rise in the iron market. The advance has not been uniform, some firms being in position to take advantage of the situation by being reasonably clear of long-time contracts; but in such cases, of course, the advance in pig iron has been paid on new purchases, as foundrymen, in view of their experience in recent years, are the last consumers of pig iron to speculate in that commodity. Any considerable purchases of pig iron except to cover work under contract or reasonably certain, are very rare.

In line with the present movement is the action taken at a special meeting of the jobbing founders of Philadelphia and vicinity, held Thursday evening, July 6, at the Manufacturers' Club, under the auspices of the Foundrymen's Association. The following resolutions were adopted:

Resolved, That on account of the rapid rise in price of pig iron, scrap iron and other raw materials, it is the sense of this meeting that the present price for iron castings is too low.

Resolved, That the price of iron castings be advanced ½c to 1c per pound, to take effect immediately.

Resolved, That should there be a further rise in pig iron, scrap iron or raw material, the price of iron castings shall be advanced at least in proportion.

The letters below indicate that the high water mark in foundry demand has not yet been reached:

The Advance in Grey Iron Castings.

In answer beg to say: As old stocks of pig iron are being used up advanced prices are coming on. A fair estimate as to the advance so far is about 15 per cent, and we are looking forward to another 5 per cent and hope soon to be in pace with present ruling prices on pig iron. From indications this holds good on all lines of iron castings in this locality. In my opinion the rapid advance of raw materials has stimulated consumption, as inquiries and specifications are on the increase, and I see no reason why it should let up, as the high water mark is not yet in sight.

W. M. SPERA.
Supt. Columbia Grey Iron Co., Columbia, Pa.

Present Prices Likely to Curtail Demand.

We have advanced prices ½c to ¾c a pound and intend to advance all those now ½c to ¾c. We, with others, hesitate about making long contracts at present rates; we also find some parties inclined to stuff their orders on unexpired contracts. We note a slight abatement in orders. We regret to see pig above $17 per ton and think the present price will curtail consumption.

ORISKANY MALLEABLE IRON CO., LTD.
Oriskany, N. Y.

The Advance in Steel Castings.

Our steel castings have advanced in price in the last six months $1.22 per 100 pounds, and our iron castings about 25 cents per 100 pounds. We do not anticipate any additional increase in iron and steel castings. The delivery of both kinds of castings and on boiler plate has been very unsatisfactory. We think, however, that in this respect there is little improvement, which leads us to believe that there will be no further increase in price, and that the delivery will probably get better. We have not made any contracts running for any length of time the last six months.

LIMA LOCOMOTIVE & MACHINE CO.
Lima, O.

Higher Prices for Castings Ahead.

A Western Pennsylvania producer of gray iron castings wirtes: "The average current price varies of course, depending upon the character of the castings. We are inclined to believe the prices on bench work have increased rather more in proportion than on heavier castings. Our work runs from very light work to quite heavy, and we should estimate

the average price at about 2¾ cents. We don't find that contracts for castings are being made for any considerable length of time ahead at current rates. In fact, we have less than half a dozen time contracts on our books to-day. We notice no abatement of demand for castings during the rapid advance in material. We believe there must come higher prices for castings within the next 90 days. The extraordinary increases in the cost of pig iron, fuel and labor, must of necessity reflect themselves in the prices for castings, and it would seem that increase in prices is apt to be more marked within the next three months than it has been during the past three months."

The Situation in the Chicago District.

Since we wrote you the latter part of April, this section has decidedly felt the advance in pig iron, which we can say has caused a general advance in the price of castings of about ¼c per pound. There has been considerable difficulty in getting castings even at the advanced prices, as trouble among the molders demanding an advance in wages, also recogntion of their union at several establishments has generally delayed the work in hand; and at some foundries patterns have been delivered without even considering the price to be charged and in some instances patterns have lain waiting their turn for a full month. While it is difficult to get gray iron castings in reasonable time, it is still more difficult to get malleable or steel castings; worse than all to get steel forgings, which have advanced with cast iron and steel castings. In conversation with some of the important manufacturers, they are seriously afraid of a reaction,—that the unwarranted advance in raw material will as usual kill the goose that lays the golden egg. We hope, however, for the best, and that no such sudden reaction will take place. Up to the present time we are of the opinion that the increased cost of material has not exerted a check upon consumption.

M. C. Bullock Mfg. Co.
John Walker, Gen'l Manager.

50 Per Cent Advance in Steel Castings.

The price of steel castings has advanced 50 per cent since the latter part of April. We are not making any contracts for castings for a long time ahead at current rates. There does not seem to be any abatement of demand for steel castings, due the rapid advance in material. In fact we now have more work on hand than we can take care of, and are turning work away every day.

Penn Steel Casting & Machine Co.,
Chester, Pa.

Large Contracts Still Coming Up.

While there is no abatement in immediate demand for castings, it is possible that contracts are not being made for time periods to the extent customary in the past three or four years. Small lots of work and contracts have perhaps been checked by the advance in cost of material, but larger operations, requiring heavy amounts of steel and iron work, are constantly being presented for estimate. The outlook is favorable for a continuance of work for both employer and employe.

Russell Wheel & Foundry Co.,
Detroit, Mich.

Advance in Malleable and Steel Castings.

We cannot give you the current prices of malleable and steel castings, other than that we might say that steel castings run from 4 cents up and malleable castings from 3 cents up. Gray iron we do not make. Material has advanced in malleable something like $15 a ton and in steel from $20 to $30 per ton.

Pratt & Letchworth Co.,
Buffalo, N. Y.

High Prices Have Some Effect.

In this city there are so many foundries ready to do the work that it is difficult to get the prices we ought to have. We are getting only 2¾ cents a pound for the bulk of our work. We think high prices have affected the market so that there is less call for castings.

Eureka Foundry Co.,
Rochester, N. Y.

A Half Cent Advance on Machinery Castings.

Our trade is in machinery castings only, and we find that most of our customers are quite willing to make one year contracts at half a cent per pound over prices prevailing a year ago. There is no falling off in orders, rather an increase.

Maher & Flockhart,
Newark, N. J.

DUFF GAS PRODUCER PATENT SUSTAINED.

A decision was handed down in Pittsburg this week in the circuit court on the gas producer patent of the Duff Patents Co., Carnegie Bldg., Pittsburg. A suit for infringement was brought against the Davis Glass Co., in the name of Alfred B. Duff, trustee, Mr. Duff is the inventor, but since July 5 has not been connected with the company, which is composed of James S. Bradley, Wm. H. Bradley, Wm. C. Bradley and Alexander Gilliland. The patent is sustained by the decision. The company is building producers for open-hearth steel furnaces, heating and annealing furnaces, glass furnaces, etc., and has now about 100 under construction. We quote as follows from the decision:

"The distinguishing features of the gas producer described in the patent in suit are a bottom casing or chamber into which the blast of air and steam is delivered; a top or cover for this casing or chamber consisting of outwardly inclined gratings having openings to distribute the blast under the body of the fuel and forming also guiding surfaces down which the residue ashes will slide towards the exterior of the producer, and free spaces below the lower edges of the inclined gratings and the walls of the producer through which the ashes will descend into a water trough which seals the bottom of the producer, and from which through the removal of the ashes is effected without making any opening into the producer and without any interruption of the air blast. These features are covered by the first and second claims of this patent.

"I have fully examined the prior patents in evidence in connection with the testimony relating thereto of the several witnesses, and I have reached the conclusion that in none of them is the combination of either the first or the second claims of the patent in suit to be found. Anticipation of either of these claims has not been shown. The improvement in the patent in suit is one of a high order of merit. The proof is full and convincing that by reason of its automatic and continuous method of operation, in point of economy, and for good results generally, the Duff gas producer of this patent is superior to any previously known gas producer. That the improvement is patentably new and useful is most clearly established.

"It only remains then to inquire whether infringement is shown. Here the case is free from any real difficulty. In all essential particulars the plaintiff's gas producer and the gas producer of the defendant are alike. The defendant has appropriated all the valuable features of the patented device and has combined the constituents in the same way. It is true that the patent in suit shows inclined gratings having plane surfaces, whereas in the defendant's structure the downward surfaces in outline are zig-zag or are formed in steps. This change, however, is purely formal. In principle the two constructions are identical. The mode of operation and the results are the same. This very clearly appears from the evidence, and especially from the testimony of the practical witness, H. L. Dixon."

American Boiler Manufacturers' Convention.

At a recent meeting of the executive committee of the American Boiler Manufacturers' Association held in Cleveland, the date of the eleventh annual convention was fixed for July 24, 25, 26 and 27. The convention will be held in Cleveland, and from data now at hand the committee in charge is satisfied that it will be one of the largest conventions that has yet been held. The business to come before the meeting will be of great importance, and the local entertainment committee will not neglect the social features, though these are not to be at the expense of the business sessions.

The Newport, Ky., city council passed over the mayor's veto an ordinance exempting from taxation for four years the Newport Rolling Mill Co., on all the valuation of its plant in excess of $25,000.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

PUBLISHED EVERY THURSDAY BY
THE IRON TRADE REVIEW CO.,
CLEVELAND, OHIO.

CLEVELAND, 27 VINCENT STREET.
G. H. GARDNER, President. A. I. FINDLEY, Editor.

CHICAGO:
1522 MONADNOCK BLOCK.
B. M. GARDNER, Western Manager.

PITTSBURG:
705 PUBLICATION BUILDING.
B. E. V. LUTY, Manager.
Telephone 1302.

BOSTON: 16 Herald Bldg. | NEW YORK: 203 Broadway.

Subscription (strictly in advance), $3 per annum. Foreign Rate, $4.
Advertising Rates Furnished on Application.

The Cleveland News Co. will supply the trade with THE IRON TRADE REVIEW through the regular channels of the American News Co.

ENTERED AT THE POST OFFICE AT CLEVELAND, O., AS SECOND CLASS MATTER

JULY 13, 1899.

PERSONAL ELEMENT IN INDUSTRIAL MANAGEMENT.

The resignation of Mr. Lorillard from the Continental Tobacco Co. is an example of the development of the personal element in the management of the industrial companies which must be dealt with before a new industrial company can be said to be on the way to a successful career. The owners of the industrial properties have made their fortunes, as a rule, from the consolidation. In the new company these same people are asked to take important official positions and are also expected to do a considerable amount of work. Because of their wealth they find the duties of the office rather irksome and in some cases perform the duties with more regard to their personal comfort than otherwise. This matter has been found all along to be one of the serious problems of industrial management, but is a matter which is now being taken hold of with more practical effort and is resulting in more resignations of these people and the substitution of harder working men. The effort to bring about this state of things is of course attended with more or less friction and in some cases has resulted in the practical disintegration of the organization. People who are asked to buy industrial securities are beginning to look at this feature of the situation more closely in order to arrive at a better understanding with respect to the efficiency of operation of the company.—[Wall Street Journal.

Without question the personnel of the iron and steel consolidation managements has had much to do with attracting investments in these stocks. To those whose connections with the iron trade have given the best opportunity for judging on this point, the abilities of those in charge of the large companies have been a foremost element in making up judgments as to the relative strength of the consolidations. A record of successful management of individual industries is the best guarantee of sound and conservative handling of the companies formed by rolling several into one. The iron industry was tried as few others were, under the stress of the panic years, and for a company to have so managed as not only to hold its own, but to improve its practice and equipment so as to come out of the five years of depression stronger than at the beginning, is a high tribute to the ability of the man or men at the helm. Such records some of those who have places of largest responsibility in certain of the iron trade consolidations have made. And on these records careful investors have acted, rather than upon stock exchange rumors or the attractive statements of financial columns.

It may be early in the day to borrow trouble on another point; but the question will be asked whether the consolidation regime is any such training school as will bring up as successors to these officials, men of like caliber. There is nothing in the world like competition to develop managerial ability. Consolidations beget a talent for finding ways and means of preventing competition. They do not take competition as a matter of course, as their predecessors did, but rather as something to be avoided. It is too soon to generalize on this point, as it relates to the iron trade combines; but their records will be watched for developments. The personal element cannot be eliminated, let the corporation be as great as it may. Comprehensive organization and smooth running administrative machinery are well; but they do not exist except as the product of controlling minds. The genius who can successfully promote and assemble is not by that token the fittest man to lead in what comes after. Perhaps the solution of the problem of the consolidation leaders of the future will be found in preserving to the largest extent, so far as management is concerned, the identity of the constituent companies, so that the competition of practice against practice, and of administration against administration, may develop the talent demanded by the highest places. The best of the leaders of today have had new problems thrust upon them in the past six months' different from any they have dealt with heretofore. How they solve them will not only determine their own future, but will help to make the stamp of men who are to hold consolidation control after them. Some may find the new positions uncongenial and weighted with too heavy responsibilities. But so far as the iron trade is concerned probably few have reached the point of anxiety to retire. The chance to make fame is too alluring to be cast aside for ease and retirement.

THE political newspapers are rehearsing for the Presidential campaign of 1900. Hence we may expect to see from this time on a great deal about the connection many writers are pleased to find between the protective tariff and the trusts. Some of the expressions we have seen in political columns, in the past two months of steady advance in iron and steel products, due to a demand outrunning supply, are of the brand of sophistry and fiction that belong peculiarly to a political campaign. It is hard to imagine to what length of misrepresentation this onslaught on the tariff will go when the heat of the campaign is upon us. The manufacturers of American tin plate, who have dared to suggest a wage advance in that industry equivalent to that which the Amalgamated Association asked of the sheet manufacturers, have been attacked viciously. The ta iff is made to carry the responsibility for every cent of advance in tin plate, by many of these vehement declaimers. Others admit an advanc in the price of tin and of steel and of labor, not governed by the scale, but pass over it as a matter of little

moment, while they go off into a welter of abuse of the American manufacturers of tin plate who took refuge in consolidation when threatened with annihilation through the over development of the tin plate industry under a tariff. What warrant have any of these critics for treating the price of Welsh tin plate laid down at New York, duty deducted, as a basis for a profitable American industry? Let them compare that price with the price charged American consumers when they were dependent entirely upon the British manufacturer. Is that the condition they would like to bring again — a condition of entire dependence upon Welsh manufacturers and the payment of tribute that such dependence has brought heretofore? Was the Welsh manufacturer of tin plate applying philanthropic methods to business when in 1891, before the McKinley tariff, when only a revenue duty existed, he received $5.25 to $5.50 a box for tin plates laid down at New York? That was the range of prices in the first six months of 1891, as compared with $4.05 at New York to-day. Years of tribute to the Welsh tin plate monopoly never evoked a protest, but six months of profitable prices paid to American manufacturers have aroused all the virulence that the mere existence of the tin plate industry in the United States has evoked from the days of its earliest triumphs.

Personal.

E. E. Moore has resigned as superintendent of the Andrews Bros. Co.'s mills of the Republic Iron & Steel Co., at Hazelton, O.

Henry B. Shields, for many years manager of the Girard Iron Co., Girard, O., has resigned and will take charge of the Wheatland, Pa., rolling mill.

David Adams, for some years connected with the Sharon Iron Co., Sharon, Pa., has resigned.

Geo. M. Summers, for more than 20 years connected with the Brown-Bonnell Iron Co., Youngstown, O., has been appointed manager of the Lake Erie mills, Cleveland, of the Republic Iron & Steel Co.

J. Q. Denny, of Harrisburg, Pa., has been elected general manager of the newly formed Susquehanna Iron & Steel Co., and will make his headquarters at Columbia, Pa., where three of the company's mills are located.

George W. Coates, chemist of the Beaver Falls Steel Works, Beaver Falls, Pa., died July 5, aged 43 years.

Geo. Eckert, of Reading, Pa., well known in the Eastern Pennsylvania iron trade, died July 5, aged 58 years. He was a son of the late Isaac Eckert, a prominent Pennsylvania iron master.

John C. Matthai, senior member of the firm of Matthai, Ingram & Co., Baltimore, Md., died July 4. He was in his 78th year. Mr. Matthai learned the trade of blacksmithing and ecge-tool making and went to Baltimore when about 18 years old. The firm of Matthai, Ingram Co. was established in 1870, by Mr. Matthai and his son-in-law, Mr. James E. Ingram.

Salem Furnace at Leetonia, O., is being improved at a considerable outlay. A new Cuyahoga blowing enigne is being built for it at the Cleveland Shipbuilding Co.'s engine works, Cleveland, and additional horse power of Cahall boilers has been purchased.

The Jeffrey Mfg. Co., of Columbus, recently gave its employes their 15th annual outing. Two special trains were required and 1,500 persons participated in the sports of the day.

The steel foundry of the Lima Locomotive & Machine Works, Lima, O., shut down for several months on account of a strike, is starting up with non-union men.

LAKE SUPERIOR IRON MINES.

The statement of the Brotherton Iron Mining Co., Jan. 1, 1899, as published for the benefit of stockholders shows the following:

RESOURCES.

Mining lease	$2,000,000.00
Cash on hand in treasury	74.32
Cash on hand at mine	1,109.01
Salem Iron Co. stock	42,900.00
Due from furnace company for ore	36,644.07
Mine inventory	36 083.41
Ore inventory	77,082.74
	$2,183,793.55

LIABILITIES.

Capital stock	$2,000,000.00
Due Sales Agent	97,570.83
Royalty, balance due	2,958.34
December pay-roll and expenses	9,306.32
Surplus	73,958.06
	$2,183,793.55

The total amount of ore shipped in 1898 was 73,197 tons. There was on hand at the mine Jan. 1, 1899, 13,291 tons and on Cleveland dock unsold, 8,157 tons.

The Oliver Iron Mining Co., has leased the Bessie mine at Humboldt, Mich., and it will be started up at an early date. It is reported also that the same company is negotiating for the old Humboldt mine which was active for more than 20 years, though idle in recent years. It has produced upwards of 700,000 tons of ore.

The Hollister mine in the Crystal Falls district, is to be unwatered and will be a producer later in the season. Oglebay, Norton & Co., of Cleveland, have acquired the lease.

The Hemlock River Mining Co., in which Pickands, Mather & Co., Cleveland, have a controlling interest, has leased the Southeast Vulcan Property on the Menominee range and renamed it the Varona. Machinery belonging to the Penn company is now being put in place.

The final total of ore shipments from upper lake ports in June, including Gladstone, the figures for which were not available last week, is 2,622,894 gross tons, as against 2,278,34 gross tons in June, 1898. The total to July 1 is 4,742,961 tons as againrt 4,612,173 tons to July 1, 1898, a gain of 130,000 tons.

The first shipment of Mesabi ore to the Ashland Iron & Steel Co.'s furnaces at Ashland, Wis., was made recently and 10,000 tons was bought as the result of the trial. Heretofore Gogebic ores have been used exclusively.

Federal Steel directors will meet this week to take further action in regard to the payment of the dividend or to provide for it in some way pending the dissolution of the temporary injunction against paying it. An effort is being made to get an earlier hearing on the injunction. The dividend was payable July 20, but the hearing was set for Aug. 20 and effort will be made to have a hearing and if possible to get a dissolution of the injunction before July 20. If the injunction is not removed it is understood that the directors will make provision to set aside quarterly dividends on common stock as they become due and pay the entire dividend in lump at the end of the year, or issue scrip.

Toronto, Ont., newspapers have detailed accounts of a blast furnace and steel works project likely to develop in the location of the industry in the eastern part of that city. Louis Schilling, of Salem, O., who is prominent in the matter, and J. W. Seaver, of the Wellman-Seaver Engineering Co., Cleveland, visited Toronto recently and looked over proposed sites. A tract of 25 to 30 acres, known as the Gooderham property, is favorably considered. The Toronto *World* says that $300,000 to $400,000 will be spent on the blast furnace plant and adds: "One of Mr. Seaver's engineers accompanied him from Cleveland as far as Hamilton, where he is to commence the construction of the new steel plant for the Hamilton Rolling Mill Co. The firm are also at present engaged in fitting up a plant in Newport, England, to cost $1,500,000, and the machinery for it is now on its way across the ocean. Mr. Wellman left Cleveland for New York to meet the members of the Japanese embassy at the Waldorf-Astoria. The Japanese government proposes to go extensively into iron manufacture, and Messrs. Wellman and Seaver are being consulted with a view to having them construct the plant."

Review of the Technical Press.

Manganese in the Acid Open-Hearth Process. [*Stahl und Eisen June 15th*]—Mr. Karl Poech reviews the recent paper of Mr. F. A. Mathewman read before the West of Scotland Iron and Steel Institute. After deploring the scarcity of open-hearth steel literature in recent years when contrasted with the self-evident need for further improvements in this line, the following points are discussed: The composition of the slag, the manganese contents of the ore, and the manganese contents of the pig iron. In working a pig iron with .5 per cent manganese the slag obtained ran 3.83 per cent MnO, while a pig iron running 1.2 per cent Mn and 2.75 per cent Si gave a slag running 13 per cent MnO. The calculated amount in the latter case should have been 9.5 per cent MnO. In working for steel castings the addition of 2 per cent of manganese results in a slag carrying 20 per cent MnO, but the average percentage obtained in the acid open-hearth process is 10 per cent. Mr. Mathewman does not think the manganese contents of an ore as very important unless an excess retards the refining action. The ore should be fed carefully and at the right time, otherwise the final slag will contain too much iron. Mr. Poech calls attention to the fact that an excess of ore at too late a period of the process injures the steel. The use of ores affects a rapid oxidation of the silicon and manganese in the baths, which result is also obtained by the use of hammer scale and pre-heated and, therefore, slightly oxidized scrap. Mr. Mathewman claims that the manganese contents of the pig iron is the more important consideration, for the bulk of the MnO in the slag comes from it. The formation of readily fusible silicates of manganese is desirable and occurs when the manganese contents of a pig iron runs over 0.5 per cent. The addition of a little lime will lower the melting point of the slag and cost very little. A high manganese pig iron instead of retarding the refining process will, on the contrary, hasten it by bringing about the boiling of the bath sooner. Where scrap is used instead of ore a soft heat is often obtained quicker with a low manganese charge than with a high one, but a careful study of the heat will show that the same degree of hardness could have been obtained in the same time with the high manganese charge were ore and scale fed in properly, and with the final addition of deoxidizing agents it will be found that a better grade of steel has resulted. That a high manganese pig iron promotes wasting is not found to be the case, or Scotch pig irons with 1.0 to 1.2 per cent Mn give as good results as English pig irons with 0.5 per cent Mn. In the latter case the manganese is practically all gone when the bath is fluid, while in the former 1.0 per cent is often present at this period. It is, however, not advisable to run over 1.2 per cent Mn in the charge in spite of the fact that an excess of MnO can replace FeO in the slag and thus save iron. Mr. Poech takes issue with Mathewman on this point and gives his experience with the acid open-hearth process as follows: Silicon should be 1 to 2 per cent, manganese 2 to 3 per cent. This means low sulpur and is comparatively cheap. If it is necessary to use scrap and low manganese pig irons the latter should be charged in such a way that they are not subject to an oxidizing flame during melting. Here as well as in the ore process the addition of spiegeleisen will be very beneficial, in fact with a pig iron containing carbon 3.42, phosphorus 0.04, manganese 1.26, silicon 2.97, sulphur 0.06, and copper 0.03, of this 30 per cent and scrap, the addition of spiegeleisen alone overcame the red shortness otherwise existing in the product. The oxides of iron and manganese have an injurious effect at the acid hearth, and the higher the manganse contents the more this is noticed. In Scotland it is customary to use principally pig iron charges in the acid open-hearth process, while in America 75 per cent scrap mixtures are the rule and little ore is used. The hearth remains in a fair condition, as the slag seems to regulate itself, 50 per cent being SiO_2 and 45 per cent FeO and Mno. The poor condition of the "bottoms" of Scotch furnaces is not due to the high manganese in the slag but to the poor construction of the large amount of ore used with the consequent great amount of slags and strong reactions. Mr. Poech recommends a system of making bottoms which gives a more compact mass than is obtained with plain layers of sand. In other words he would first put in a layer of well-burnt fire brick, then another of silica brick, and over this a 5-inch layer of fire sand. The sides and ends are carried up in layers dipping outward on this bottom. In starting up the hearth is thoroughly cleaned by melting acid slags on it, then comes the final layer of one inch of fire sand well burnt.

In discussing Mr. Mathewman's paper Mr. Mills opposed the use of high manganese pig iron for steel as uneconomical and injurious to the hearth. Mr. Dick uses irons up to 2 per cent manganese but not above. Mr. A. Campion calls attention to the value of manganese in removing sulphur and also thinks that low manganese irons are desirable. Mr. Hugh Barclay, however, states that by using high manganese irons the bath is protected from undue oxidation and that ferro-manganese additions can be reduced as a consequence. Mr. Campbell, of this country, sent in a written discussion, in which he asks the Sctoch steel makers to face conditions and not theories. In Scotland scrap is carefully avoided at the beginnng of the charge, while in America it is placed directly on the hearth and the pig iron added last. Thus we are able to make four 5-ton heats, three 25-ton, and two 50-ton heats in 24 hours, the bottoms holding up very well, and the time consumed in charging and the consequent cooling of the furnaces alone reducing the number of heats for the heavy charges.

Silicide of Iron.—*Zeitschrift für Electrochemie* reviews a new process by P. Lebeau for making silicide of iron in the electric furnace. In the preparation of metallic beryllium by reducing the mineral beryl with coke or calcium carbide, a number of crystals of the following composition were found in the residium: Silicon, 26 per cent; iron, 30 per cent; copper, 41 per cent; and carborundum, 3 per cent. A close examination revealed the fact that the silicide of iron is readily soluble in fluid silicide of copper and crystallizes out on cooling. Again on heating iron with the silicide of copper we obtain silicide of iron. The process in question is therefore based upon this reaction and is carried out as follows: Forty grammes of iron fillings are mixed with 100 grammes of commercial copper silicide and melted in a graphite crucible with a current of 950 amperes at 45 volts. The crystalline product thus obtained is dissolved in nitric acid, which removes the silicide of copper. The residue is washed with a soda solution, again treated with nitric acid, washed with water and then dried. Crystals of silicide of iron with bright metallic lustre are the result. In view of the demand for a form of silicon which does not carry with it carbon or phosphorus in the production of high grade steel, this process should be of value.

A Record of Heavy Pig Iron Sales.

As an indication of the revival in the iron business since Jan. 1, the report of Rogers, Brown & Co. is interesting. Their statement of sales of pig iron for January to June inclusive shows 716,000 gross tons, an increase of 44 per cent over the corresponding period of last year, when they sold about 500,000 tons.

Rogers, Brown & Co. announce that their sales agency connection with the Tennessee Coal, Iron & Railroad Co. will cease on Aug. 15. They report an increase in foreign demand at better prices, but extreme difficulty in getting iron for deliveries required, and scarcity of ocean room.

Important improvements are to be made at a number of plants of the Republic Iron & Steel Co. The capacity of the plant at Minneapolis, Minn., will be greatly increased by building additional open-hearth furnaces and by adding equipment in several departments. At Youngstown, O., the Brown-Bonnell Iron Co.'s mills will be overhauled and the more effective ones put in the best working shape. Phoenix Furnace will be torn down and scrapped. The Valley mill at Youngstown will be supplied with 600 h. p. additional boiler capacity. At Sharon, Pa., improvements will be made to Fannie Furnace and to the Sharon Iron Co. mills.

It is announced that Matthew Addy & Co., of Cincinnati, have been appointed the general and exclusive sales agents of the Tennessee Coal, Iron & Railroad Co., the arrangement becoming effective Aug. 15. They will have the sale of all the brands made by this company, which, with the Sheffield property recently purchased, is now the owner of twenty furnace stacks. The Tennessee Coal, Iron & Railroad Co. is the largest concern in the world producing iron for the general market and this consolidation of its agency arrangements marks an important change.

PIG IRON FOR MALLEABLE CASTINGS.

BY C. E. WHEELER, DAYTON, O.

There has existed for a considerable period, a feeling of uncertainty among blast furnace managers concerning the requirements of the malleable iron casting industry, on specifications for pig iron. This has been occasioned in a great measure through the disinclination of buyers to state any too clearly the limits desired in percentages of impurities, and thereby compelling furnaces to produce iron, which varied in the gradings from No. 1 to No. 7. Years ago, during the early progress of this industry, charcoal iron was the only raw material considered, and is, to-day in many quarters the only metal charged into the reverberatory furnaces. Charcoal iron has never lost for a moment its position in the malleable foundry; but the production being so limited, its place has been taken by the advent of the cheaper coke irons. Chemistry was an unknown factor both in blast furnace practice, and malleable works; and when the air furnace was charged with the charcoal burden, the latter was continued under heat influences until the combination of the carbon with the metallic iron had been effected. The duration of heat varied greatly, of course, and this difference in heat operation was very naturally laid to inequalities in the pig iron. This explanation seemingly went no further, as the idea of metalloids affecting the composition of metal, had not then been projected. There were no limits placed upon silicon, sulphur, phosphorus or manganese; and outside of carbon very little was really known of the metal. The real variety came in the grading, and we must admit now the careful manner in which metal was selected for malleable cast iron.

There are many malleable concerns which dispense with the services of a chemist, and to-day it seems more consistent, as they are furnished by blast furnaces with carefully determined analyses from which heats are calculated; and in a casting industry a chemist's real territory commences with results, rather than checking up initials. There is hardly a blast furnace extant, which is run without a laboratory, and analyses are always furnished. It would be a retrogression for any one to maintain that just as good material was produced in the old days of the industry as now, and there is no likelihood of the admission being made, that nothing has been learnt in 40 years of business.

From an intimate association with blast furnace practice, and some little experience in malleable cast iron founding the writer begs to present a few deductions so gathered. It is hoped that while they are the result of practices purely local, they may strike some points of interest to others, whose experience covers somewhat similar lines. In an industry like the malleable, where it is said that no two furnaces work exactly alike, greater variance of ideas may be expected than in steel. But in following these deductions the writer has made fairly good material, and in thus presenting them, trusts they will contain some interest for all.

Heat Influences All-Important in Malleable.

Malleable casting, like its companion art, gray iron founding, is greatly a matter of local practice, and only general principles hold good. If no two furnaces work alike, as has been stated, it is more a question of heat influences, than a chemico-physical one requiring an entirely radical change in mixtures; for it is not within the limitation of sound reasoning to suppose that one foundry placing all its confidence in, say, phosphorus, and another in silicon, would arrive at the same results, with the same satisfaction and confidence. If the above is a fact, and the writer has good reason so to believe, then we are reaching our ends through the disregard of some very important associate influence, without acknowledging its presence. Pig iron is the same, all over the country, and does not act peculiarly in localities.

The most advantageous movement in the direction of uniformity in malleable calculations, would be the establishment, to the satisfaction of all concerned, of what really is the one dominant metalloid in pig iron. We believe from their daily association with its many phases, that the blast furnace managers are the ones to decide this point. In the calculating and mixing of irons for the malleable burden a mixture is desired, which will have, when the metal is hot enough to pour, all of its carbon in combination with the metallic iron, and if, when the metal is hot enough to tap, this said condition has not been effected, and iron is held in furnace under continued heat influences, then the initial calculation has been at fault. Therefore it might be said that if blast furnaces could supply malleable foundries with an iron having a great proportion of combined carbon, the ideal metal would be at hand; and so it would, if combined carbon were a controlling influence, as graphitic carbon is. Combined carbon is present in large percentages only when the heat condition of original casting at blast furnace has been very low, and if a heat were charged into the reverberatory furnace of this iron, the metal would only be suitable for the casting of heavy shapes, as its own native heat is very low. Pig iron high in percentages of graphitic carbon has been produced under high thermic conditions at the blast furnace, and such iron is high in fluidity, through its association with an element which always stands for latent heat, namely silicon. When pig iron is high in percentage of combined carbon and necessarily low in latent heat, it does not derive any advantage from a metalloid present, and one which is an acknowledged factor for fluidity, namely phosphorus, because there has not been enough heat present in the metal to free it. The action of phosphorus in conjunction with silicon is assured to all careful observers, both in gray iron and malleable founding.

Silicon the Influential Metalloid.

In view of the foregoing facts, we must turn to silicon as the most influential factor in pig iron, and together with furnace conditions it is certainly the governing element in all irons from the No. 1 to No. 7, charcoal or coke. The other metalloids are void of effect, if the silicon is not prominent enough to give metal sufficient life, and thus enable them to free themselves to act. Silicon in pig iron is purely the result of a blast furnace heat condition. When the stack is working hot, silicon and graphitic carbon will be high; when the furnace is cold and scaffolding, silicon is low, and combined carbon high. Malleable makers do not desire an iron in which the percentage of silicon is very high, or in excess, for there are many negative features encountered in such metal; but they do require an iron medium in silicon, and with a low total carbon. In all of the metals, the result of furnace manipulation, the lower the carbon, the softer or more ductile these materials will be, and malleable iron is no exception to this rule. To affect a combination of irons in such proportions that the chemical reaction of the annealing process will have a certain effect toward the elimination of carbon in appreciable quantities, is the secret of all malleable practice.

In the casting of heavy shapes which do not require the maximum fluidity, it is found possible to use the "higher" brands of iron, from No. 4 to No. 6, because the carbon in such irons is in an advanced state of combination, and such castings being poured with this metal, cool very rapidly, retaining their original contour lines, with segregation. Heavy castings poured with "low" metal, or metal high in silicon, would upon cooling, not only allow of segregation, but would also be "gray." This latter feature would be brought about, with the continued heat present in casting subsequent to cooling, allowing graphitic carbon, which had been in combination, to separate under conditions so very favorable. We all know the result of trying to anneal a "gray" malleable casting. It is invariably worthless, always burnt, because there has not been enough combined carbon present to offer resistance to heat of annealing ovens. The great features of malleable castings are malleability, ductility, and the ability to withstand heavy shocks, without losing the original lines of the same. These properties are not possible when the material after annealing has an excess of carbon present.

In looking over the analyses of both charcoal and coke irons, there is but a small difference noticed in the quantities of total carbon in all the grades from No. 1 to No. 7, and therefore the hope of procuring an iron low in total carbon seems very forlorn indeed. It is only in freak casts that such a condition is possible.

A Complex Change.

Transformation which takes place in a metal during its continuance in annealing ovens under high heat conditions, in which the carbon changes from the combined state, back to its original condition in pig metal, of graphitic carbon, is not

altogether the result of this heat influence, for if it were, the carbon would not have been thus affected. The strains both internal and external would have been greatly relieved, and as in the instance of the other metals, the annealing oven would have played its part. But in the annealing of malleable iron, the operation means more than ordinary explanation conveys. There is, of course, nothing which will accomplish this result but heat, and in this peculiar instance, it is accompanied by a chemical action, different in every particular from other annealing processes. It is virtually the turning backward of the carbon with a loss, to the advantage of the metal. The fracture of an annealed casting and that of a gray iron casting differ in every particular. There is nothing in the original pig metal which suggests the change of fracture, for in the finished material there seems an altogether complete evolution in formation, and it is still within the limits of good reasoning to argue that the molecular formation in pig iron had entirely disappeared giving place to an atomical creation, the proof of which suggests itself in the homogenous character of fractures. It is hardly possible to "break" a good piece of malleable iron. The separation is more in the nature of cleavage than breakage; while in the instance of gray iron, it would be a break pure and simple. When castings of large diameters are being annealed, the operation is necessarily longer, as the carbon will not "let go" until a point beyond the highest heat unit of initial casting has been reached.

The idea is steadily gaining ground that, in connection with analyses of pig iron furnished founders, some knowledge of the initial heat conditions will at a future day be of the greatest assistance, for often we meet with a condition in malleable melting, and which follows the usage of both charcoal and coke metals, when the heat will be hot enough to tap, but the carbon is still holding off, and will not enter into combination until enough silicon has been burnt out, to reduce the excessive thermic condition in the bath. In looking over calculations made for these heats, one can seemingly gain nothing from the analyses, as there is nothing suggestive of the contingency. If we do not recognize a heat condition we are at a loss for an explanation. Just how this anticipated change will shape itself can be only a matter for conjecture, and should it follow the line of etching tests we will be in a measure prepared for it.

The Influence of Sulphur.

Sulphur in pig iron is the most objectionable of all the metalloids. Being a product of a heat condition in blast furnaces (strictly speaking coke stacks), it does not lose for one moment its power to work powerful effects at all times during the process. It is difficult for the modern manufacturer to accept sulphur as being beneficial, though this in substance is really being argued in several quarters. Excepting some special "off" grade of malleable in which a large percentage of sulphur is used for a special purpose, we know of no branch of metallurgy accepting it with favor. In charcoal iron, from the nature of ore and fuel used, sulphur is always at a minimum even throughout the "higher" gradings. In coke iron it is prominent not only through the influence of the class of fuel used in reducing the ore, but also in the ore itself. When the higher gradings of coke iron are reached, we find blast furnaces working cold, and the metal absorbing sulphur at a rapid rate. When this "high" iron is re-melted in air furnaces the product, upon annealing, will show all those unmistakable characteristics found in steel making. Sulphur has affinity for nothing but itself: once in sufficient quantities it will invariably assert itself. The tendency toward permeation is so strong that the metal will always be "short," with a decided inclination toward crystalline formation instead of a homogeneous construction. This latter feature is met with very frequently, and is sometimes difficult of explanation. Malleable concerns do not want, nor have they encouraged the use of, iron high in sulphur, and in the selection of coke iron, have repeatedly taken refuge behind the bulwarks of a Bessemer limit to aid them in purchasing. The absence of sulphur in charcoal iron has been recognized for years, as one of its strongest points. If coke furnaces would offer a uniform article in respect to sulphur, it could be used in malleable throughout all its various gradings But on account of the atmospheric and other conditions which govern stacks, the "high" coke iron can never become a factor in the casting arts. There is no doubt but that sulphur in excess will combine carbon with the iron to a point higher than that attainable through simple furnace operations, but this point is offset in malleable by the danger incurred in metal through this somewhat negative reasoning. The limits for sulphur in all irons offered should not exceed .045, to produce successful castings.

The Effect of Phosphorus.

There seems at present a feeling among malleable makers that phosphorus in coke iron will be accepted with the same degree of confidence as was phosphorus in charcoal iron, in the early progress of the art. Malleable castings for many years were made from charcoal iron in which the percentage of phosphorus was rarely below 0.20, and yet with the introduction of coke iron phosphorus was regarded as extremely hostile to the process and iron was specified to the Bessemer limits. The supposed propensity was to cause metal to be "cold short" or brittle when cold. There has been no method devised as yet which will eliminate phosphorus in the blast furnace, and until the "basic" furnace is adapted to malleable purposes, it will be a condition to be met. Being organic and having affinity for oxygen its combination with metallic iron is made by absorption, when metal is passing through the fusion zone of the furnace. When in the pig iron in appreciable percentages, it does not in the process of remelting for malleable purposes exert its influence in any degree, except under certain conditions, and those are when the latent heat of the metal is sufficiently high to free it. In metals graded Nos. 5, 6 and 7, phosphorus is at a standstill regarding heat conditions favorable for its action. We do not know in exactly what light phosphorus was considered in years gone by in malleable founding, but the theory has stood for a great while without proof that outside of its chemical reactions it made pig metal weaker physically.

In the old days the malleable mixtures were made up by the grading system, and iron was chosen with peculiar reference to the aggregation in fracture, even though it was all of the same quality. The distinction was made and the rule followed, that all iron, if uniform in structure, no matter what its quality may have been, yielded better and worked much more satisfactorily than it would have, if mixed with iron of varied fractures and analyses. In other words, it was counted as unprofitable to melt weak iron with a stronger, as there would be a "melting loss" to meet far above the average. It is generally conceded (theoretically) that iron of the same composition, be it weak or strong, unites with the smallest losses. In the matter of loss in melting, where the percentage runs as high as 10 and 12 per cent of total weight charged, there would certainly appear ample field for improvement. When a heat of "high" iron is charged into the reverberatory air furnace, its yield is markedly greater, than when a gray iron charge is compared, which has to undergo the boiling and oxidizing process which follows. The reasoning for this difference is only too obvious when considered for a moment. When the metal is hot of itself, and combined with the induced heat of blast, there is no question that phosphorus is the foundryman's friend for fluidity.

Manganese has gained more in favor during the past few years than any of the other metalloids. There have been many reasons for this, and its accepted worth is due to its ability to hold shrinkages within reasonable limits, together with its effect upon the final combination of carbon in bath. Its formation in pig iron is generally considered as an oxide and is, of course, readily affected by the flame of the blast. When in large percentages it acts as a flux in the distinct removal of sulphur. Manganese at high temperatures is acted upon by the burning of the silicon, and is thus converted almost entirely into a protoxide, which combining with the silicon in formation of slag, carries with it appreciable amounts of sulphur. Manganese, however, does not act, only when the heat conditions are above the normal, and this necessary feature will be recognized from the condition of slags drawn out of furnaces. The percentage of manganese specified for malleable pig iron has risen from the charcoal limits of 50 until now 1.50 is specified in many instances. The objection has been raised that these high percentages acting upon the carbon, render castings in the annealing ovens hard, making extra hard firing necessary to remove the carbon successfully. This latter theory has yet to be proved, and if it is so, it is of course acting directly contrary to the theory of the

malleable anneal, which is that any substance having an affinity for carbon, will remove the same under a high heat condition.

The original methods were somewhat different from those followed in many quarters, yet are still extant. Malleable cast iron is produced by a process of decarbonizing cast iron, by cementation; and the original method was packing castings in iron ore, which at a high heat imparted its oxygen to the carbon in the iron, forming CO. From this process arose the term hematite malleable iron. The adoption of automatic casting apparatus by blast furnaces, will enable them to offer the foundry user (and especially the malleable concerns) an article superior to the sand pigs of to-day. It is believed that the carbon will be in a higher state of combination with the iron, and it is hoped that the total percentage of carbon will be lower. The effect upon silicon content will be watched with great interest, as we anticipate some change in this particular, which will affect the grading. Metal which at hearth of furnace when tapped, showing two per cent silicon, will lose in some marked degree, upon the chilling consequent to the use of chill molds. If this furnace treatment should be very severe the subsequent handling must be along other lines than those at present pursued in malleable casting. Sandless pigs will bring with them a decidedly welcome feature of economy, both in fuel consumption, and obviating the removal of debris, which now follows the skimming of every heat. It is a most decided advancement in blast furnace product.

The adoption of standardized drillings is without question of great assistance, both to furnace managers, and founders, and another step which suggests itself in this connection, would be the adoption of uniform methods for laboratory analyses, by all parties concerned. We know for a certainty that blast furnace chemists will offer uniform results, when working upon the same sample, and by from reason of this fact their analyses may be accepted without checking. Chemistry has not entered into the foundry industry to the extent one might suppose its unquestioned worth would warrant and there are many reasons for this delay. You can never tell whether there are two ways of producing a casting, until the second method has been tried, and it is the conclusion of those who have tried two ways, that chemists of sufficient breadth have accomplished and carried out more economies at the furnace, to the direct advantage of the metal, than all the rule-of-thumb melters. Encouragement here, more than in any other department of founding, has worked toward making output uniform and satisfactory.

Southern Furnace Interests Absorbed.

Another deal in Southern coal and iron properties has been made. John E. Searles and Abram S. Hewitt, of New York, and some their leading New York and Boston associates, the International Trust Co., of Baltimore; Middendorf, Oliver & Co., of Baltimore; John L. Williams & Sons, of Richmond, and others, are connected with it. A syndicate, with a capital stock of $5,000,000, has been organized, all of which has been underwritten, and has purchased the Clifton Iron Co., owning 30,000 acres of land and the two Clifton furnaces, at Ironaton, Ala., one making coke iron and the other charcoal iron; the Standard Coal Co., owning 32 000 acres of coal lands; the Mary Pratt Furnace in Brimingham the Gate City properties adjacent to Birmingham (purchased some months ago by Baltimore and Richmond interests), and the Gadsden, Ala., furnace and ore properties in connection therewith. The building of 400 coke ovens and the further opening up of coal mines are now under way. Gadsden furnace will be rebuilt. T. G. Bush, president of the Clifton Iron Co., will be president of the new company, and F. M. Jackson, general manager of the Standard Coal Co., who has operated that property for the last 10 years, will have general charge of its coal and coke interests. The properties will be paid for in full. The new company will start without indebtedness of any kind, as no bonds are to be issued, and it has ample working capital.

Not long ago it was agreed by all interests on the great lakes that with big ships and deep channels the days of high freights had passed. Dollar ore was to be only a memory. But the freight market to-day has practically reached the dollar figure. A dollar a ton is said to have been paid on one load that a shipper was forced to move to Buffalo. It is certain anyhow that there are no ships to be had to move ore from the head of the lakes at less than a dollar, and the grain rate from the same quarter is equal to more than a dollar. Probably 40 ships were chartered in two days at 40 last week cents on coal from Ohio ports to the head of Lake Superior, which is just double the rate that prevailed all through last season. These advances are due largely to grain shippers bidding for the vessels. The movement of grain from the northwest would seem to indicate that the farmers are getting rid of it in anticipation of very heavy crops, and vessel men are correspondingly happy.—[Marine Review.

World-Wide Advertising for American Manufacturies.

In a London letter to the *Engineering News*, "G. H. F." makes this interesting comment on the way in which American manufacturers have been receiving the attentions of the world's best agents of publicity, in their campaign for foreign business:

"The American exporter is the best advertised individual of this era of newspaper enterprise. The space which is so dearly purchased by the British manufacturer is given, without stint and without price, to chronicle the triumphs of American competition in the markets of the world; to explain in detail the superiority of manufacture, the excellent features of shop practice, the wonderful organizing ability and the inventive genius, the labor-saving machinery and the time-saving devices of the exceedingly practical and enterprising nation across the Atlantic which is now confessedly pushing its commerial victories at a rate quite unparalleled in previous history. The recent awards of considerable contracts for American bridges and American locomotives over the heads of English manufacturers were telegraphed to the remotest corners of the British Empire, and it is no exaggeration to say that in every newspaper publishing ordinary news of the day reference of some kind has been made to this startling victory of American trade enterprise. Class journals have commented on the subject from every point of view, magazines have had more lengthy and weighty articles; even society proceedings show from the hard-facts-dealing view of their learned authors the causes of the superiority of American products. These opinions and comments speedily make their way to American newspaper columns through the media of the telegraph office, press cuttings, special correspondence and consular reports, and in the dollar-a-line space of the great city dailies the triumphs of the live Yankee intelligence, capital and enterprise, are again widely advertised to an appreciative nation, which is in turn stimulated for further conquest. Truly, then, the American exporter is the pet of the newspaper fraternity; his lines have fallen in profitable places; may he duly recognize his obligations with substantial fraternity."

The Chicago & Aurora Smelting & Refining Co., with works at Chicago and Aurora, Ill., and Leadville, Col., has been merged in the American Smelting and Refining Co., which owns the principal large smelters of the country. It has abandoned the manufacture of Babbitt metal excepting the filling of a few orders on hand, although it had made a specialty of the manufacture of this material for engines, rolling mills, etc., in the past two years. C. H. Reeves, Jr., who was in charge of this department, has resigned and become identified with Merchant & Co., Inc., of Philadelphia, New York and Chicago. Merchant & Co., Inc., have been operating large smelting works for many years in Philadelphia, and have always been very active in the manufacture of Babbitt metals. They are now in position to supply the former customers of the Chicago & Aurora Smelting & Refining Co. with all the "Aurora" grades of Babbitt metal they have been accustomed to use.

The Sloss Iron & Steel Co., Birmingham, Ala., is opening a large mine on its property near the Brookside mines, and erecting 100 coke ovens at the same place. The four furnaces belonging to this company are in full blast, and the coal and coke are needed.

The South Chicago Furnace Co.'s remodeled Calumet Furnace was put in blast last week.

BEVEL GEAR GRINDING MACHINE.

A machine has been perfected by the Leland & Faulconer Mfg. Co., of Detroit, which cuts the working surfaces of the teeth of a gear to the correct outline after the gear has been hardened. It is known as their bevel gear generating grinder. It is well known that in order to secure smooth running and perfect action of bevel gears, all the working faces must have a definite relation to the apex or cone center, and the teeth should be uniform in thickness, accurately spaced and concentric with the axis of the gear. Hence, in designing the machine illustrated, every attention has been given to secure all these conditions in hardened bevel gears. It has been demonstrated that it is absolutely necessary to have the gears used in the chainless bicycle hardened, otherwise their life would be short indeed. Heretofore this hardening has been done after the gears have been made from soft steel as perfect as practicable by the latest special machinery, which is complicated and expensive. The process of hardening these gears introduces various errors, warps and changes the form of the gears so that the working faces of the teeth are not concentric with the axis of the gears, the spacing becomes irregular, and the teeth lean one way or the other. Hence, the finished product was left, before this gear grinding machine was developed, in the imperfect condition brought about by the hardening process.

The idea of grinding gears after hardening was conceived by H. M. Leland, and the machine was designed jointly by Mr. Leland and Frank E. Ferris, one of the company's designers. Patents were granted on May 9, 1899, the machines having been in operation for a considerable time previous, 10 of them in the works of the Pope Mfg. Co., at Hartford, Conn. The cutting is done by a corundum wheel of specially hard material, and of special construction. Its periphery travels at a speed of nearly two miles a minute. Fig. 1 gives a view of the machine, showing a gear in position to be operated on by the abrasive wheel. The former is shown at B and the former-arm, which carries it, is seated on the spindle and yoke frame shown about midway on the quadrant, to which reference is made later. The former is generated in the machine itself and is geometrically correct, and the grinding is so accurate that the resultant surfaces are reduced copies of the former, the tooth curves being exactly reproduced.

The frame which carries the gear-holding spindle is shown in Fig. 2. It is yoke-shaped at its upper end and is pivoted on two bushings, the axis of which passes through the cone center of all gears generated on the machine. The standard taper hole at the upper end of the frame receives the arbor on which the gear is placed; at the lower end is mounted the index plate, having the same number of notches as the teeth of the gear. The gear-holding frame and the spindle with the gear mounted thereon may be swung on its pivot around the cone center line and clamped on the quadrant so that any bevel gear used in a bicycle from 15-tooth pinion to a 50-tooth crank-gear may be correctly generated on the machine.

The frame which carries the reciprocating ram, Fig. 3, which in turn carries the abrasive wheel, is also pivoted on one of the same bushings upon which the gear spindle frame swings. The back end of this frame has a vertical movement imparted to it by means of a cam, shown at A, Fig. 1. This

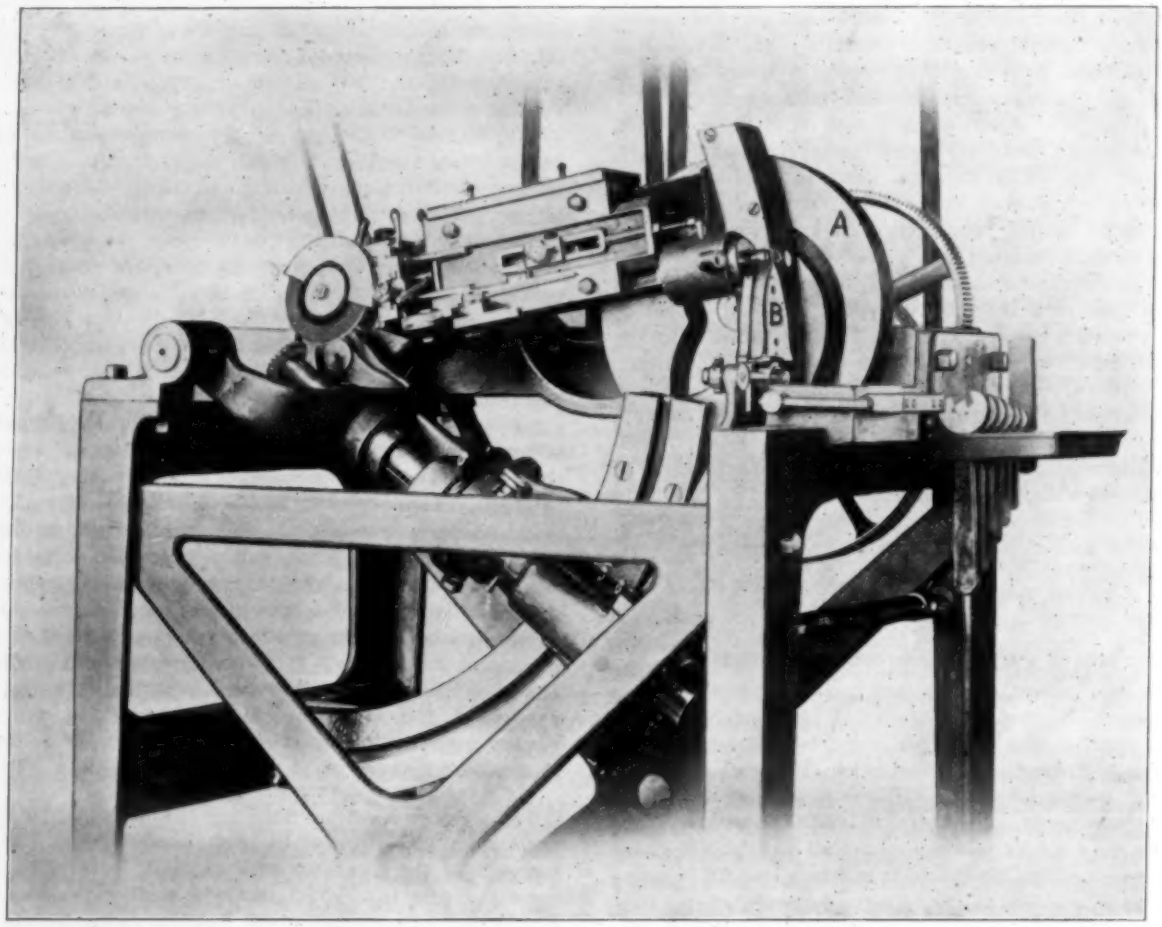


FIG. 1.—BEVEL GEAR GENERATING GRINDER.

vertical movement carries the cutting edge of the abrasive wheel on a vertical line, the plane of which passes through the cone center. This ram also has a reciprocating movement imparted to it by an eccentric cam which causes it to reciprocate on radial lines from the cone center above explained. This ram reciprocates about 500 strokes per minute, and is mounted in suitable steel guides. This ram also has a universal head which can be tilted in either direction. The abrasive wheel which does the cutting is properly mounted on this universal head. The head is so constructed that it can be adjusted in all directions by accurate micrometer screws reading to a fraction of a thousandth of an inch. The cutting edge of this wheel travels or reciprocates in a line that is radial at all times to the cone center, at the same time that its cutting edge is moving up and down in a plane which passes vertically through the cone center. Thus the cutting wheel has a rotary movement, a reciprocatory movement on the cone line of the gear, a vertical movement, and a swivel movement,

to give clearance thereto in its work on the side of the teeth of the gear, while it may also be vertically or laterally adjusted to maintain its proper relation to the teeth of the gear and the cone center.

The ram frame carries a roll at its moving end as seen in Fig. 1. As the frame is moved in a vertical direction, this roll travels on the former, thereby rolling the spindle with the gear mounted thereon, and thus giving the correct curve or outline to the tooth being acted upon by the abrasive wheel. As the wheel is at the highest point of its upward movement, the spindle is rotated by means of the indexing mechanism, and the wheel, as it goes down again, cuts the face of the next tooth.

The gear spindle, Fig. 2, is provided with a worm and worm wheel, which are encased and by means of which the gear may be revolved without turning the index plate. This allows the gear to be placed and secured to the spindle by any suitable means, and then rolled until the central line of any tooth of the gear comes into precisely the correct relation to the former. It is then ready to be acted upon by the cutting wheel. When the gear and the wheel have been once properly adjusted, all the functions of the machine are automatic, and its various movements are continued until the gear is finished, when it will be found to be theoretically or geometrically correct, and that every essential requirement called for by the most exacting and refined tests will prove that the machine has made the most perfect bevel gear, hard or soft, that has yet been produced by means heretofore in use. No other machine so far as we are informed has ever been made, that will produce a perfect hardened bevel gear. When it is considered that about 350,000 revolutions of the cutting wheel of this machine are required to grind one gear, some idea is obtained of the work it performs. Unusual accuracy has been attained in the manufacture of the machine. Working limits on nearly all the pieces composing it have been made very close and exacting.

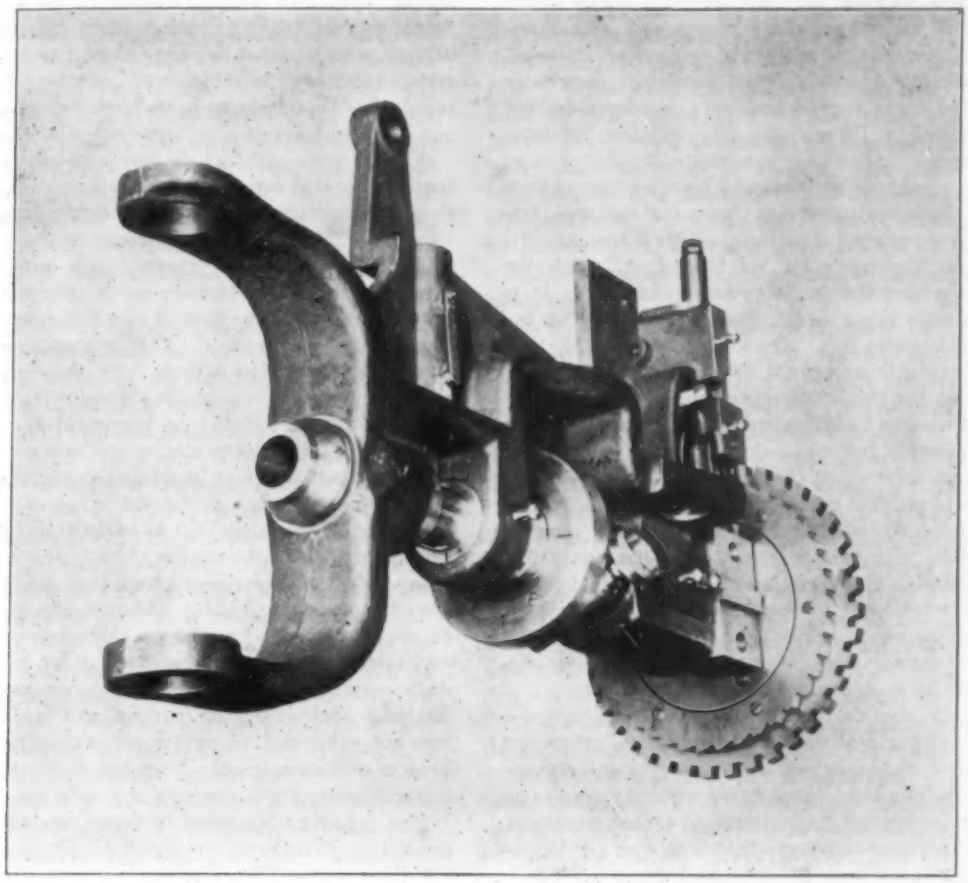


FIG. 2.—YOKE FRAME AND GEAR-HOLDING SPINDLE.

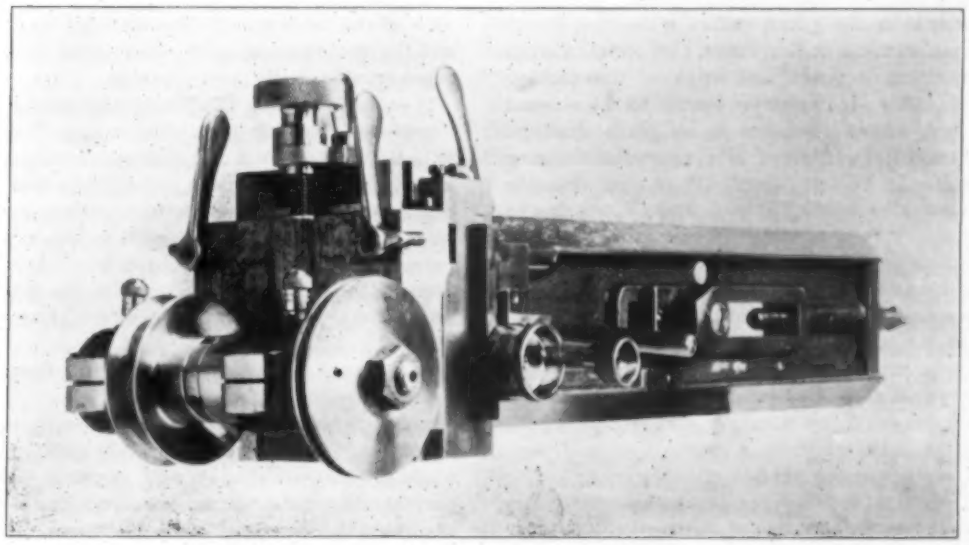


FIG. 3.—FRAME FOR RECIPROCATING RAM, WHICH CARRIES THE ABRASIVE WHEEL.

GOVERNING MIXTURES BY SILICON.

The paper of Bertrand S. Summers, of Chicago, read at the Buffalo meeting of the American Institute of Mining Engineers, has attracted the attention of a number of careful students of the mettallurgy of cast iron. Mr. Summers' contention is that the influence of carbon has not been given due prominence in the study of controlling elements in cupola mixtures. The following contributions to the discussion of the paper have just been published by the American Institute:

R. S. MacPherran, Milwaukee, Wis. (communication to the secretary): The importance of carbon in pig iron, as well as the desirability of buying, for some purposes, irons which are high in carbon, has always been recognized. Mr. Summers, I think, has given undue weight to the carbon-determinations. The combined carbon often decreases materially as the center of the pig is approached, with a corresponding increase in the graphite. Even the determination of total carbon, to be of service, must be supplemented by that of other elements. By it alone, the softness of a foundry iron cannot be determined. Car wheels and No. 5 iron, for instance, frequently contain 3.75 per cent of carbon. This is the percentage specified by Mr. Summers for his No. 1 iron, "with the silicon about anywhere the furnaceman wants it." It is true, that other things being equal, the higher the carbon the softer the iron for foundry use. But to introduce any given percentages of graphitic and total carbon into a pig iron specification would but make the specification more complicated, without increasing its value in a commensurate degree.

Mr. Summers does not believe in the governing of mixtures by the silicon, and, in support of his views, gives several tables. It seems to me that both his conclusions and his tables are somewhat unsatisfactory. He comments on the regularity in carbon, but fails to note the significance of the irregularity in silicon. The variation of 0.7 per cent in silicon, for example, is too great to be accounted for by difference in blast. It might better be attributed to bad grading at the furnace, unsystematic sampling, or irregular charging. Deductions drawn under such conditions are of little value.

In ordinary work the castings from the same mixture should not vary 0.15 per cent, in silicon, and for cylinders and special work do not vary 0.10 per cent. As the percentage of silicon increases from the least possible amount up to nearly 3 per cent, the ratio of graphite to combined carbon increases, if the other conditions are constant—that is, if the conditions of cooling are not altered, and if silicon and iron are the only elements, the percentages of which vary. The influence of any given percentage of silicon is the more powerful, the lower the total percentage of that element present. A change of 0.10 to 0.20 per cent in No. 5 iron makes a decided difference in the carbons; whereas in No. 1 iron, this effect is often overshadowed by the more potent influence of the cooling conditions. To the latter Mr. Summers seems to have paid no attention. I say "seems" because in no place does he mention them, or record any attempt to preserve uniformity of casting and cooling in his test pieces. It is just possible that some of the anomalies in his Tables I. and IV. are due to this cause. The conditions of pouring, cross sections of piece, etc., are of the utmost importance in determining the relative amounts of graphitic and combined carbon in the casting. An iron which, in a small casting, would be white, may be perfectly gray in a large one. It may, indeed, be said that all iron is gray, if slowly enough cooled. Let me illustrate this proposition in physical as well as chemical terms. An iron cast in a 1-inch test-bar may give a tensile strength of 35,000 pounds to the square inch, while, in a heavy fly-wheel segment, it will not average 20,000 pounds.

In conclusion, I wish to express my agreement with Mr. Summers, that the indiscriminate use of ferro-silicon is to be condemned. Within its proper sphere, it is often of great value; but it is too frequently employed as a remedy for all ills.

Dr. R. Moldenke, Pittsburg, Pa. (communication to the secretary): In studying Mr. Summers' paper one must admit the patience with which he has worked to present a theory at variance with the conclusions of all the leading scientific founders; but one cannot fail to notice the continual contradictions, or, let us say, a periodic hiatus between his results and the conclusions derived therefrom. He frankly discards the idea that silicon is the important element in cupola mixtures, and aims at controlling the graphite. Right here Mr. Summers will be met with the stubborn fact that the amount of graphite present in a casting is a function of the silicon present, the casting-temperature, and the rate of cooling; the total carbon, of course, coming into play to some extent, though it is very seldom so low that special precautions (in the form of an increase in silicon by the way) must be taken to keep the casting safely fit to be machined. Leave out the silicon, and how would Mr. Summers govern the graphite? The hotter the casting temperature, the higher the combined carbon, which means lower graphite; the thicker the section, the slower the rate of cooling, and hence the higher the graphite. As the rate of cooling depends upon the dimensions of the casting, which cannot be changed, and as the casting temperature is capable of being lowered only by allowing the ladle to stand after tapping, and cannot be raised if required, what can Mr. Summers do if he ignores the silicon?

A much more satisfactory way is to adjust the silicon contents to the fuel ratio blast, and other cupola conditions, and thus approximate correct results every time. The instances cited by Mr. Summers of pig irons in which the silicon was found not to govern the graphite are entirely misleading, as it is well known that furnace casts vary very much in temperature, and the same iron, if cast hot, may be white, while, if cast cold, it will be gray. This proposition applies to cases of comparatively low silicon. As the percentage of silicon rises, the sensitiveness of the carbon is lessened to some extent; but the rule holds true, nevertheless.

Considering seriatim the points brought out by Mr. Summers, we find, first that he admits the most prominent feature of the effect of silicon to be the promotion of the graphite formation. He claims that as to the requirements of this reaction nothing absolute can be stated, which is not quite the case; for many experienced founders govern their work by the silicon contents exactly. Again, the claim is made that charcoal and coke irons of the same composition show differences due to carbon conditions, in which temper carbon plays an important part. While this is an open question, it is doubtful whether temper carbon will be found in any cast iron not subjected to prolonged annealing. The effect of greater oxidation in coke irons has much to do with the peculiar appearance of charcoal and coke iron fractures.

The question of sulphur is taken up next, and its effects are noted. The limit proposed by Mr. Summers, if not applied to ordinary foundry work, is too high, though special kinds of castings may stand 0.10 per cent of sulphur without harm.

On the manganese question it will pay us to "go slow," in view of the tendency of this element to harden the metal, and (by combination with sulphur to make hard spots) to cause trouble in the machine shop.

It were better if Mr. Summers would avoid the term "semi-steel," which means nothing, as the metal it is used to designate is only a cast iron running very low in carbon, and having a high tensile strength (below that of malleable cast iron, by the way), a little more elongation than the weaker grades of cast iron, and, as he states, more magnetic permeability. This is no reason why a new name should be used, in these enlightened days, for the upper grades of material having all the properties of cast iron and none of those of steel.

In the tests made on bars high in phosphorus, the results reported by Mr. Summers should be supplemented by their size and the distance between supports; otherwise they are worthless. In the instance of the high grade irons, erroneously called semi-steel, which showed such differences in permeability and fracture, would not the temperature in casting account for most of such differences?

It seems that Mr. Summers' experience has been principally with ferro-silicons; but, as every founder knows, these are to be used with great caution in cupola work, as such mixtures lack uniformity, and, as a consequence, the results are far from certain. It is much better to make use of irons of nearly the composition required in the charge than to mix up scrap and ferro-silicon, although, theoretically, this should be just as good.

In the discussion of that part of Mr. Summers' paper, which concerns the relation of silicon to graphite, the tables given, and

the deductons made therefrom, fail to be of value, because the temperature conditions are not stated. The anomaly of a pig iron with 3.36 per cent of silicon, yet having all its carbon in graphitic form, which is attributed to local conditions, would be better laid to heat and cooling conditions in the making of this exceptionally peculiar iron. Indeed, Mr. Summers subsequently declares that temperature controls the effect of silicon in pig iron, as well as in iron from the cupola, the amount of air used to burn the fuel in a given time producing effects which must not be neglected; and it may be added that the amount of fuel with which the melted iron comes in contact, while dripping through it, affects the total carbon also.

Inasmuch as the carbon question in pig irons is a comparatively simple one, any specifications which include this element, must be a burden to the furnaceman; and, again, any specifications requiring a minimum of graphite in pig iron must make an expert founder smile when he thinks of the fact that chilled car wheels, when remelted and poured "dull," give perfectly gray castings.

On the whole, the paper of Mr. Summers is a curious one, and well worthy of study by founders who wish to note to what ideas the copious use of ferro-silicon in daily mixtures gives rise.

R. A. Hadfield, Sheffield, Eng. (communication to the secretary): I have read with special interest the excellent and most interesting communication by Mr. Summers on "Modern Cupola Practice." The title alone does not do justice to this important paper, as in several instances it offers solutions for results obtained from cast iron alloys which, to the best of the writer's knowledge, have not been satisfactorily explained elsewhere. As an example, I would cite the very nteresting theory stated by Mr. Summers, with regard to Prof. Ledebur's temper carbon, as being carbon in a "transition state towards graphite." I am glad to note that Mr. Summers regards as tenable the idea of the existence of a carbide manganese. The hypothesis of such a combination appears to me much more satisfactory than the invoking of allotropy. It cannot be doubted now that carbide of iron exists; and there should, therefore, be little doubt as to the existence of another carbide in the same group of elements as that which includes both iron and manganese.

I am specially interested in the observations regarding the existence of silico-carbide, having myself produced some very peculiar alloys of silicon iron containing carbon. They possess special hardness—in fact, when properly treated, almost that of self-hardening steel, without the brittleness of the latter. Although silicon has been ordinarily a despised element, its use, when properly applied, is much more serviceable than is ordinarily imagined.

On the other hand, as Mr. Summers properly states, in ordinary foundry practice this metalloid has often been attributed to its qualities, both good and bad, for which the real responsibility was due to other causes, some of which he himself has well and clearly shown. This has arisen, no doubt, from the fact that the influence of silicon on carbon is very important, and that the results observed were due rather to the condition in which this element was found than to the amount of silicon per se.

In conclusion, I would again say with how much interest I have read this paper, feeling sure that, to the practical man, who often sees that current theoretical explanations do not always fit in with the facts he notices, it will specially appeal. As a British member of the American Institute of Mining Engineers, I hope that we may have more communications from Mr. Summers, and that he may see his way to put his views before our Iron and Steel Institute for discussion on this side.

Mr. Summers: Replying to Mr. MacPherran, I would say that I cannot agree with him that total carbon varies too much to permit much dependence to be placed upon its determination. I have frequently checked this point, and find that, when care is exercised, the carbon determinations are nearly as uniform as those of silicon. The drilling should be taken from different positions. Six pigs compose our sample, equal parts of each being taken. Mr. MacPherran has mistaken my meaning in this regard. I do not claim that one can judge of the softness of pig iron from the total carbon, but that one can certainly do so from the graphitic carbon. In the specification to which he refers, a graphitic carbon limit is also specified, which puts another phase on the question. I believe firmly, and this is confirmed by practice, that the carbon specification is more important than that of silicon.

Without attempting to account for the variation of 0.7 per cent in silicon mentioned by Mr. MacPherran, I must say that, if his point is well taken, it seems to me we should look for considerable effect upon the graphitic carbon. I am unaware that any positive claim is made in my paper that the blast could increase the silicon to the degree mentioned. Mr. MacPherran seems to have better control of his burden than is common, in normal practice.

As to the remainder of Mr. MacPherran's remarks, they all state admitted facts of foundry practice, and I cannot see that they affect the data given by me. As to the size of our castings, I will say that they were all taken from the same pattern, 0.5 by 0.5 by 12 inches in size, giving a bar too small to permit any noticeable amount of segregation. Moreover, as great care was taken to maintain the same conditions for each casting, it is doubtful if any anomalies can be traced to different rates of cooling, etc. This conclusion is confirmed by the fact that, with the same charge, I have found the graphite the same in castings made from this pattern at different times.

Dr. Moldenke's remarks are so based on orthodox foundry ideas and opinions that I can scarcely make any reply to them. He is mistaken, however, in understanding that I have labored to "present a theory at variance with the conclusions of all the leading scientific founders." I do not claim originality for the "theory," as he calls it; but I have found that it explained anomalies in foundry practice which I could not explain by the ideas in which I had been schooled. Dr. Moldenke asks how one can govern the graphite if the silicon be left out? If he can govern the graphite with the silicon, he is more successful than I have been. I do not attempt to govern the graphite. I simply get as much graphite as I can, and control the total carbon by mixing high or low carbon iron or scrap, as the case may demand. Again, if we want fine machinery iron, I think it is accepted as the best practice to fix the silicon at about 2 per cent. How, then, if we thus fix the silicon, and if it controls the graphite under all circumstances, are we to control the graphite? Perhaps Dr. Moldenke would not fix the silicon at any fixed amount, but would vary it until he got the graphite content he wished. If so, I can only say that he differs from the best practice. The two most widely known and recognized manufacturers of fine machinery do not follow such a plan. The analyses of their castings show:

	No. 1.	No. 2.
Silicon,	1.90	1.87
Sulphur,	0.092	0.116
Phosphorus,	0.822	0.656
Manganese	0.325	0.325
Graphite carbon,	3.29	3.15
Combined carbon,	0.17	0.51

These castings were small, and one was a standard test-bar, 1 by 1 by 12 inches in size. Evidently, in this case, silicon has not been the controlling element, and has been kept as low as one well could keep it in foundry practice, for this grade of work. To what, then, was the percentage of graphite due? If the conditons mentioned by Mr. MacPherran and Dr. Moldenke are responsible for these results, then conditions are more potent than silicon in producing graphite, which is the point I wished to bring out in this connection, though I have not endeavored to define the conditions. I think Dr. Moldenke will find that a larger number of scientific founders differ from him than he is aware of.

Regarding the statement that the limit 0.10 per cent for sulphur is too high, I can only refer Dr. Moldenke to the above analysis, whch represents one of the best machinery cast irons on the American market; and also observe that, in normal foundry practice, sulphur is seldom below 0.06 per cent.

As long as "semi-steel" is an accepted term in the trade, I can see no objection to its use, especially as the semi-steel referred to is about 50 per cent steel. The name is not new nor original with me, and, as far as I know, does not purport to describe the properties of the metal.

In my opinion, the use of ferro-silicons is too general in this country to need discussion. There are scarcely any foundries

where they are not used. I do not think, however, that they are often employed with too little discrimination.

Dr. Moldenke's "expert founder," who does the smiling at graphite specifications, "when he thinks of the fact that chilled car wheels, when re-melted and poured 'dull,' give perfectly gray castings," can probably explain why it is difficult to get a soft gray iron to chill, although the silicon is low. In this connection one may be excused for thinking that an iron of high graphitic content, though it may be low in silicon, is frequently of good use as a softener, since experience seems to show that it is easier, by the use of it, to make a casting high in graphitic carbon under normal conditons. I confess, however, that this proposition is open to dispute.

I would say that I am not an advocate of "the copious use of ferro-silicon." In fact, it is against this practice that my paper is directed. But I am far from agreeing with Dr. Moldenke, if he means to say that their use should be avoided.

With Mr. Hadfield's ideas regarding manganese I am in accord. It is by no means certain that this element cannot be used with advantage in foundry practice, to prevent oxidation, etc. the marked effect of manganese on both permeability, hysteress and permanent magnetism of iron and steel certainly points toward the existence of a carbide of iron.

My paper was written, not to advance a new theory, but to invite discussion, and to discover whether others, as well as myself, have found difficulty in controlling foundry mixtures by means of silicon. It does not seem sensible to talk of controlling cooling conditions in commercial practice; and if foundry conditions are more potent than silicon in controlling graphite, some, at least, of our current beliefs and traditions should be modified.

I wish to record my support of Mr. Bachman's criticism of the work done in support of what I may call the "silicon theory." It is well known that Mr. Keep's work was far from complete from a chemical standpoint, as well as from a metallurgical one. There were so many conditions in Mr. Keep's work that might have accounted for his results as to permit serious doubts concerning his deductions. I myself have prepared irons by melting in graphite pots mixtures of ferro-silicon iron and wrought iron drillings, which certainly make very curious alloys.

The following are the analyses of some of these pot irons:

	I. Per Cent.	II. Per Cent.	III. Per Cent.	IV. Per Cent.	V. Per Cent.	VI. Per Cent.	VII. Per Cent.	VII. Per Cent.	IX. Per Cent.
Silicon.....	1.14	0.58	0.916	1.037	0.504	0.134	1.776	2.546	2.60
Manganese.....	0.228	0.062	0.359	0.227	0.132	0.425	0.661	0.698	0.49
Sulphur.....	0.046	0.038	0.059	0.055	0.048	0.057	0.074	0.052	0.045
Phosphorus.....	0.412	0.269	0.723	0.794	1.049	0.664	0.886	1.139	1.154
Gr. carbon.....	0.006	Trace	Trace	Trace	Trace	Trace	Trace	Trace	None
Com. carbon.....	2.006	2.519	2.63	2.51	2.59	1.27	1.77	1.74	1.15

These irons were compounded for the purpose of studying the effect of the different elements upon the magnetic permeability of iron; and a more complete description of them can be found in the *Journal of the Society of Chemical Industry* for December, 1897. In no case was the graphite over 0.06 per cent, and, the percentage being so small, the determinaion was neglected. The irons, some of which were covered with charcoal in melting, absorbed large contents of carbon, nearly all of which remained in the casting as combined carbon. It will be noted that the silicon varied from 0.5 to 2.6 per cent. This has not affected the peculiar composition of the iron in any way. I cite these results to show the errors liable to arise in deductions made from small experimental heats and in basing foundry practice upon them. Especially is this true where accurate chemical analysis does not accompany the work.

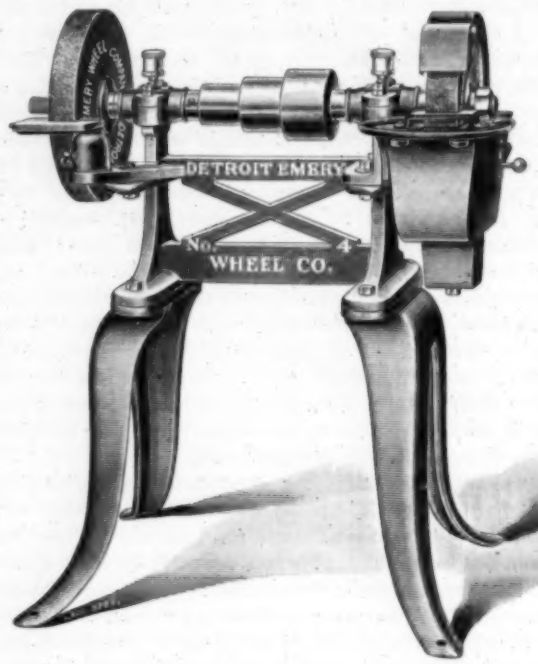
It seems to me that the advocates of the effect of silicon upon carbon are a little too bigoted in their advocacy of the theory, and frequently a fair hearing is not given to data presented in opposition. I certainly think the matter worthy of further investigation, every care being taken to discover the truth; and it does not seem to me advisable that these contentions should be scorned simply because they are not concordant with established belief or individual opinion. In support of this view, the valuable data presented by Mr. Bachman should have great weight.

W. C. Heimbuecher, of 36 La Salle st., Chicago, has been appointed exclusive sales agent for the Detroit Twist Drill Co., of Detroit, for the Northwest.

THE DETROIT EMERY WHEEL CO.

One outcome of Mr. Gilbert Hart's career of 26 years as a manufacturer is shown in the extensive operations of the Detroit Emery Wheel Co., corner of Jefferson and Field aves., Detroit, Mich., well-known throughout the United States as well as in Europe. Having some ideas of his own regarding combination of materials, and best methods to employ in producing a wheel insuring the greatest economy of use in grinding and largest possible safety, Mr. Hart decided to put them into practice. He started with a 30x30 foot shop, in 1873, employing a few hands. From that time he has made grinding wheels his special, experimental study, and has steadily increased his output. He now carries 70 men on his pay-roll, and the plant embraces about 20,000 square feet of floor space. Since the first of the year it has been found necessary to run 12 hours daily in order to keep pace with orders.

Notable success has been attained in securing temperate, steady men, who become so well satisfied with the policy of the firm, that very few changes are made. It is stated that not more than one dozen men have been discharged since the organization of the concern, and in these cases the cause was irregularity of habits. This long-continued service of the men permits of great uniformity in the product, which is in large part hand work. Special wheels of all sizes, degrees



of hardness, composition and shapes, to stand slow or rapid running, wet or dry work, are made daily to meet the demands of the many different kinds of work on which wheels are employed. Both corundum and emery wheels are manufactured. About 20 different sized grits enter into the ordinary range of sizes used. A large stock of all kinds of raw material is kept on hand, with a view to keeping up the record of the concern, of filling all orders for special wheels on the day following their receipt. This rapid production of wheels is the result of an original process used in composition, mixing, forming, baking, finishing and testing, reaching a result in 24 hours, that with some producers involves processes occupying several weeks duration.

To meet the demands of the foreign trade, a factory has been established recently in London, Eng., and is now in operation. Besides a line of emery oil stones, made from Turkish emery, gouge slips of oval shape, round edge slip stones, emery knife sharpeners, etc., a full line of grinding machinery of original design is also manufactured. Something new in this connection is a water tool wheel device, which can be attached to a grinder in a few minutes, making a perfect water grinder, as shown in the illustration. J. Wendell Cole, Columbus and Chicago, is selling agent.

The American Pig Iron Storage Warrant Co.'s stocks in yard June 30 were 50,800 tons, 5,700 having been withdrawn and 100 tons put in yard in the preceding 10 days. On June 30, 1898, warrant stocks were 258,000 tons; on June 30, 1897, 221,600 tons and on June 30, 1896, 112,000 tons.

ROPE-DRIVEN TRAVELING CRANE.

Albert B. Tenney, assistant secretary of the N. V. Perry Mfg. Co., Boston, manufacturers of metal turning machinery, has designed a traveling crane, to be operated by rope transmission. Its construction is indicated in the illustration, showing moving parts adapted to be operated from a single vertical shaft carried by the crane, actuated by rope-transmitted power and connected with shafts operating the moving parts by friction clutches. Fig 1 is a view of the crane, principally in end elevation. Fig. 2 is a plan view, showing by diagram the relation of the operating rope to the crane and its vertical shaft. The trolley track on one side of the shop is shown in Fig. 1. The crane is mounted in the usual way. It is propelled upon its tracks, the trolley is moved cross-wise of it, and its lifting and holding chain C are all operated to be moved in either direction by the single vertical shaft D and interposed frictional clutches.

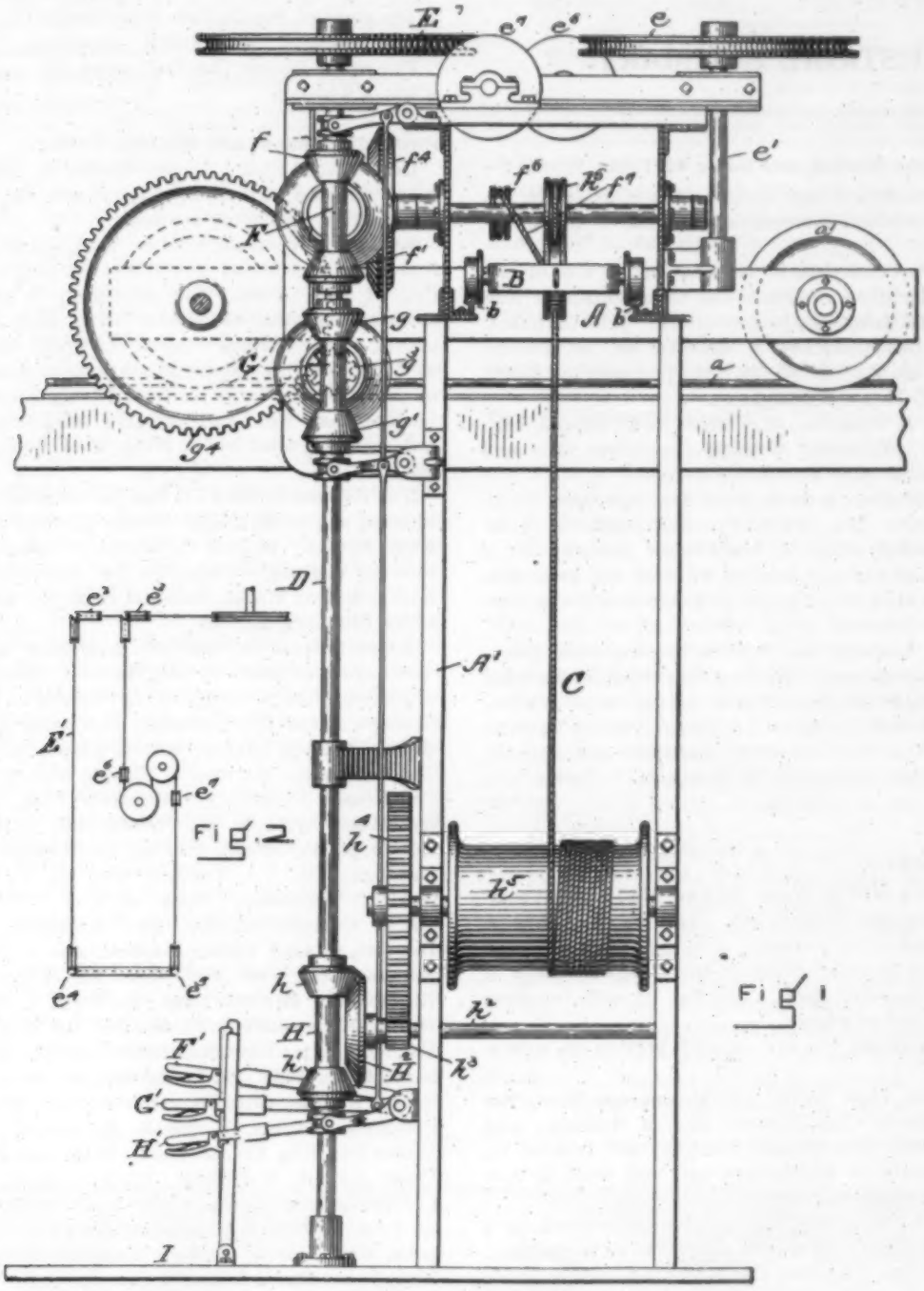


Fig. 2

Fig 1

The inventor claims that the employment of the vertical shaft permits the rope transmission to be simply and readily applied and permits direct application of power to the wheels A¹, the trolley and the drum for winding the chain. By employing the friction clutch the crane can be operated by ordinary labor, a safety factor being introduced which is not obtained by positive clutching devices. Strain is relieved, permitting of easy starting of the crane or the load, the clutches being manipulated by the operator by means of the levers shown and provision is made for the slip of the main shaft in respect to the connections. The power transmitting rope E¹ extends lengthwise of the tracks, A, and around guiding and holding pulleys arranged at the two ends of the path of travel of the crane. The vertical shaft D has arranged upon it three reversing frictional clutches. Each of the clutch parts comprises two members in opposed relation to each other, connected together, to be simultaneously moved by an operating lever. The winding drum is connected with the trolley in the usual way by means of a rope f⁷, one section of which extends directly from it to the trolley, another section extending from the drum across the crane about a sheave f⁸ upon the opposite end of the crane and returning to the end of the trolley nearest it to which it is attached. The movement by the operator through the lever F¹ of the clutch part F in a downward direction causes the clutch surface f to be brought into engagement with the beveled or inclined clutch surface of the clutch part f_2, when the winding drum f^4 will be turned and the trolley and the load which it carries moved in one direction. The movement of the clutch part F in an opposite direction will cause the clutch surface f to be removed from the clutch surface of the part F², and its further movement will cause the clutch surface f' of the part F to be brought into operative engagement with the clutch surface of the part F², thereby reversing its rotation and causing the

drum f[8] to be turned to move the trolley and its load in an opposite direction.

One of the cranes was installed recently in the plant of the West Indian Fibre Co., of Salem, Mass. The crane originally was driven by hand power, three men being required to handle two tons of cocoanut husks in a day of ten hours. The problem required that this should be doubled and permit the use of the crane for other purposes. The building in which the crane operates is 40x100 feet and it has a hoist of 30 feet. By means of this equipment one man is enabled to do in three hours twice as much as three men did in 10 hours. The company refers to the saving of time and labor by the use of this crane, much more work being done in a fraction of the time formerly required.

INDUSTRIAL SUMMARY.

[I you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

"R." care of the *Iron Trade Review*, Cleveland, is in the market for a second-hand locomotive for industrial use; cylinder 10x14 inches.

Among the new Pennsylvania corporations is that of the Canton Roll & Machine Co., Leechburg, to manufacture iron and steel. Capital $100,000. Incorporators: J. E. Carnham, W. J. Steele, of Leechburg; W. M. Bleecker, of New Castle; H. L. Smith, of Smithfield, W. Va.; A. J. Steele, of North Baltimore, O.; F. Kepp, of Allegheny.

Kelly Foundry & Tank Co., of Elkhart, Ind., capital $40,000; directors: Edward, Howard B., Della M., and Josephine Kelly, has been incorporated.

The Scullin-Gallagher Iron & Steel Co. has been incorporated at St. Louis, Mo., to build a steel plant, it is reported. John Scullin, of the St. Louis Street Railway Co., is prominent in the project. A tract of 54 acres has been purchased at Clifton Heights, at a cost of $100,000, and the erection of a plant is promised.

The National Foundry Co., of Erie, Pa., has been incorporated at Harrisburg; capital $100,000. The Pass City Foundry & Machinery Co., of El Paso, Texas, capital stock $10,000, has been incorporated to conduct a general foundry business and factory for the manufacture of machines and engines. Incorporators, Alvin Richey, T. H. Tracy, S. T. Turner, and others.

New Construction:—

The new foundry of Wm Ward, Milford, Me., is about completed. The main shop is 30x70 feet. The machine shop is 20x40 feet, two and a half stories.

Work has begun on an addition to the Baugher, Kurtz & Co. foundry and machine shop, York, Pa. It will be 96x84 feet with a wing 32 feet square.

The Milwaukee Boiler Co. will expend $16,000 on a new boiler shop.

The Menominee Iron Works Co., Menominee, Mich., has sold its plant to the D. Clint Prescott Co, of Marinette and Duluth, for $30,000. The Prescott company will remove its plant from Marinette to Menominee, and will build a new foundry at a cost of $15,000.

The Quincy (Ill.) Stove Mfg. Co., has let the contract for a new foundry at $15,000. It will be completed in September.

The American Steel Casting Co., which has added to its Chester, Pa., plant, has bought another piece of land 484x365 feet, and will build a further addition.

The two new furnaces to be built by the Illinois Steel Co. will be located south of the Cheltenham tract at 86th st., South Chicago.

The National Steel Co. has awarded to the New Columbus Bridge Co. the contract for the erection of its new blooming mill building at Steelton, Columbus, O.

It is reported that the International Traction Co. will erect a steel car manufacturing plant at Buffalo and it will be ready for operation early next year. Plans have been made, but the site has not been selected.

The Birmingham (Ala.) Machine & Foundry Co., has received $42,000 in adjustment of its fire loss. It will rebuild at once. Among other machinery burned were two 2,100 h. p. engines built for the Alabama Steel & Wire Co. It is expected that two engines to take their place will be finished by October.

H. W. Caldwell & Co., of Chicago, are about to build two machine shops to cost $50,000, at 1152-77 West 17th st.

The Chicago & Northwestern Railroad Co., will erect annexes to its machine shop and boiler shop at Chicago.

The Vulcanus Forging Co., of Cleveland, will erect a shop to take the place of the one recently burned.

At Muncie, Ind., work has begun on the Kitselman wire fence factory and it will be ready for operation in the fall.

Fires and Accidents:—

The plant of the De Ved Sash-Weight Co., Baltimore, was nearly destroyed by fire July 3; loss $8,000.

Fire at the Illinois Can Co.'s plant, Chicago, July 6, caused a loss of $150,000.

Power Equipment and Machine Tools:—

Dean Bros.' Steam Pump Works, of Indianapolis, Ind., have increased their capacity 25 per cent over that of last year and are now employing 250 men.

An order for machinery has been placed in the United States by the Russian government through M. S. Friede & Co., of New York. The machinery is intended for the temporary machine shops now being built at Harbin, Manchuria, on the Chinese Eastern Railroad. It will include a car lathe, weighing about 42,000 pounds, double axle lathes, of various sizes, large vertical boring mills, double steam hammers and hand and portable twist drills. Part of the order is being filled by the Niles Tool Works Co., of Hamilton, O.

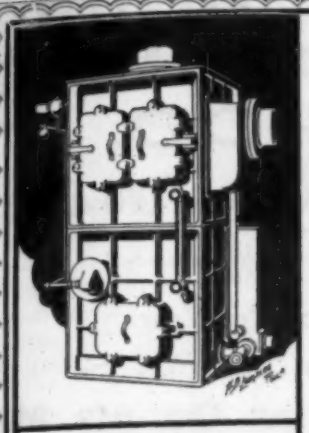
The Edward P. Allis Co. has just received an order for a blowing engine for a blast furnace plant in the Birmingham, Eng., district. In June the company booked nine orders for blowing engines. These go the Pennsylvania Steel Co., Riverside Iron Works, National Steel Co., and to companies in the Pittsburg district.

Recent sales of the Cochrane feed water heaters and purifiers have been made by the Harrison Safety Boiler Works, of Philadelphia, to the following concerns: Illinois Steel Co., Chicago, 22,000 h. p; Deering Harvester Co., 4,000 h. p.; Edison Electric Ill. Co., Boston, 4,000 h. p.; Duluth Furnace Co., 1,500 h. p.; Mariopol & Nicopol Mining & Metallurgical Co., Russia, 2,500 h. p.; Worcester Elec. Lt. Co., Worcester, Mass., 1,500 h. p.; Philadelphia Exposition of 1899, 2,000 h. p.; McCormick Harvesting Machine Co., 1,500 h. p.; Saratoga, (N. Y.) Traction Co., 150 h. p.; Andrews & George, Yokohama, Japan, 50 h. p.; Rockland, Thomaston & Camden St. Ry. Co., Rockland, Me., 250 h. p.; Danvers, (Mass.) Insane Asylum, 600 h. p., special; Reed Furnace Co., West Middlesex, Pa., 1,250 h. p.; Harroun Elevator Co., Elwood, Kans., 350 h. p.; J. E. Botsford, Port Huron, Mich., 500 h. p.; Lancaster Ice Mfg. Co., Lancaster, Pa., 500 h. p; Commonwealth Electric Co., Chicago, 3,000 h p.; Boyle Bldg., St. Louis, Mo., 150 h. p., special; Ruddy Bros., Kansas City, Mo., 200 h. p.; Steger Piano Co., Columbia Heights, Ill., 300 h. p., special; Atwood & MacManus Box Mfg. Co., Chelsea, Mass., 250 h. p.; Middleton Paper Co., S. Middelton, Mass., 200 h. p.; Fort Worth, (Texas) Lt. and Pr. Co., 850 h. p.; Holman Paper Box Co., St. Louis, Mo., 50 h. p, special; Reichard & Pattee, Minneapolis, Minn., 100 h. p.; New England Engineering Co., 500 h.p.; Texas Steam Laundry, San Antonio, Texas, 50 h. p.; Henry Vogus, Whetmore, Texas, 100 h. p.; Beacon Falls Rubber Shoe Co., 250 h. p.; Pittsburg Terra Cotta Co., Pt. Murray, N. J., 500 h. p.; Spartansburg, (S. C.) Elec. Lt. & Pr. Co., 600 h. p.; A. B. Norton, Kittanning, Pa., 425 h. p.; Geo. W. Smith & Co., White River Junction, Vt., 100 h. p.; etc.

The Pittsburg District:—

The Pennsylvania Casting & Machine Co., Pittsburg, has been chartered with $1,000 capital stock, which is merely nominal. The directors are Joshua W. Rhodes, J. D. Rhodes, N. L. Elkins, Jr., A. N. Slocum, J. M. Tate, Jr., and Spang, Chalfant & Co.

During the last week in June the Pressed Steel Car Co., Pittsburg, delivered 205 steel hopper cars of 100,000 pounds


COCHRANE HEATER

Really Didn't Need New Boilers.

One of our representatives, some three or four months ago, called at a plant where they were about to buy two new boilers—tried to sell them a heater, but they "had one—didn't need another," though they were greatly troubled with scale. Finally, we got the opportunity of investigating the plant—600 h. p. of boilers. 300 h. p. of the steam they made was passed through a closed heater, but because of scale and insufficiency of heating surface, the feed supply was delivered at a temperature of only 140°. Putting in a **COCHRANE HEATER,** *and making some changes in the piping, will mean to the owners of that plant a saving of close to twenty (20%) per cent of their total fuel bill, or a net saving each year (they run 24 hours a day, seven days each week) of about $2,500.00, or, with coal consumption as at present, they can take 20% more work from the old boilers. The new boilers will probably not be needed.*

This illustrates what can be done by properly utilizing exhaust steam. The foundation of an economical plant is a COCHRANE HEATER. They are conceded by many of the largest steam users to be the most practical, common sense appliance for the purpose now on the market.

HARRISON SAFETY BOILER WORKS,
Clearfield & 17th Sts. Philadelphia, Pa.

capacity to the Pittsburg & Lake Erie Railroad, and 17 to the Lake Shore & Michigan Southern, on an order for 1,000. In addition the company shipped 100 carloads of trucks, bolsters, center plates, etc., to various railroads.

The Braddock, (Pa) Machine & Mfg. Co., which recently completed a new machine shop in connection with its foundry, has broken ground for an addition, 50x80 feet.

The McKeesport, (Pa.) Springless Lock Co., has been formed by Dr. A. E. Karsner, of New York City, O. E. Wales, of Philadelphia, and James L. DeLong, and W. E. Hartman, of EcKeesport, and has leased a building at Versailles, near McKeesport, to manufacture hardware specialties.

The American Steel & Wire Co. is preparing plans for the large modern blast furnace to be erected, as noted in these columns, on the company's property adjoining the Edith stack in Allegheny City, Pa. The rebuilding of Edith Furnace was recently completed.

The Amalgamated Association scale has been signed for the Old Meadow Rolling Mill Co., Scottdale, Pa. It will be remembered that before the present owners took charge there was some difficulty at this plant because the original company, which had been formed at the instigation of the strikers from another sheet mill, had refused to longer pay Amalgamated wages.

The United States Radiator Co., West Newton, Pa., has purchased the A. T. Stewart agricultural implement works, at the same place, embracing a large tract of land, with a foundry and a number of brick buildings.

The American Steel & Wire Co. started the Braddock plant in operation latelast week and early this week the Rankin plant was started.

M. M. Garland, surveyor of the port of Pittsburg, is organizing a company to be known as the American Safe & Lock Co., to operate the safe manufacturing plant at Elizabeth, Pa.

The puddlers at Spang, Chalfant & Co.'s plant at Etna, Pa., are still out on strike for recognition of the Amalgamated Association, but the mill continues in operation.

Jones & Laughlins, Ltd., Pittsburg, are gradually getting their finishing mills in operation. The roughers at their mills, after having signed a scale governing wages to Dec. 31, broke faith with the excuse that they had not expected the present market conditions when they signed the scale. Eight finishing mills were affected, and of these four are now running as usual, while the remaining four are likely to be put in operation within a few days.

General Industrial Notes:—

A scale has been arranged at New Castle for the plant of the National Steel Co. This is the only one of the steel plants of the company in which the men are organized as members of the Amalgamated association.

The tinning department of the Johnstown plant of the American Tin Plate Co. was started in operation Monday.

It is probable that the Excelsior Furnace at Ishpeming, Mich., will not be operated again.

After a shut-down of a year the merchant mill of the Joliet plant of the Federal Steel Co. has started up.

It is announced at Youngstown, O., that the money has practically been pledged to secure the Ingersoll Milling Machine Co., now of Rockford, Ill.

The project for a tin plate plant at Scranton, Pa., is being revived. L. K. Torbet, of Chicago, is negotiating with the board of trade.

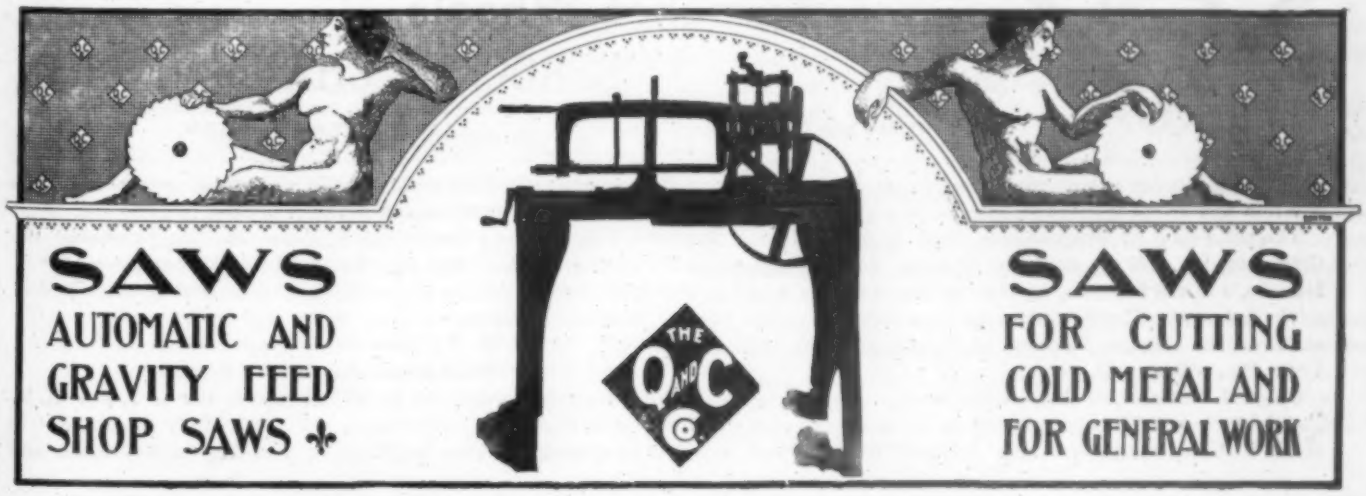
The Warder, Bushnell & Glessner Co., Springfield, O., has purchased the old Whitely malleable foundry at Springfield to increase its foundry facilities.

The charcoal furnace of the Gaylord Iron Co., Detroit, has resumed operations.

The scale has been signed by the Union Steel Co., of Alexandria, Ind., and the new purchasers will put the various departments in operation as rapidly as possible.

The last of the equipment of the old Briggs rolling mill at Findlay, O., has been sold for shipment to Cleveland.

The Brooks Locomotive Works, Dunkirk, N. Y., recently



MOUNT SAVAGE FIRE BRICK.

UNION MINING CO,

Proprietors of the CELEBRATED Mount Savage Fire Brick

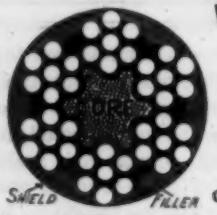
GOVERNMENT ‡ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

The First Manufactory of its Kind in the U. S.

Home Office and Works:—MOUNT SAVAGE, Alleganv County, Md.

Branch Offices:—No. 1 Broadway, New York, N. Y.; No. 222 So. Third St., Philadelphia, Pa.; Ferguson Block, Pittsburgh Pa., Stowe, Fuller & Co., 249 Arcade, Cleveland, Ohio; N. A. Williams Co., 219 E. Washington St., Chicago, Ill.



WHY NOT PRESERVE YOUR Wire Ropes, Manilla Ropes, Gearing? Catalogue L tells how.

THE IRONSIDES COMPANY, COLUMBUS, O., U. S. A.

When writing to advertisers, kindyl mention this paper.

THE RIVERSIDE FOUNDRY CO., Cleveland, O.

Rolling Mill, Rod Mill, Wire Mill and Blast Furnace CASTINGS of Every Description.

CHILLED AND HARD GUIDES A SPECIALTY.

OTIS STEEL

"OTIS" FIRE-BOX PLATES A SPECIALTY.

Flange Plates, Ship Plates, Tank Plates, Steel Car Axles and Forgings of all kinds.

Steel Castings from 100 to 75,000 lbs.

Head Office and Works, CLEVELAND, OHIO.

Agencies: NEW YORK, 97 Cedar St. CHICAGO, Old Colony Bldg.
ST. LOUIS, 516 N. Third St. WASHINGTON, Kellogg Bldg.
MONTREAL, Homer Taylor, 183 St. James St.
SAN FRANCISCO, John Woodlock, 154-156 First St.

HENRY L. SCHWARZENBERG,

CRUCIBLES.

REPRESENTS

R. B. SEIDEL'S Philadelphia Black Lead and Crucible Works.

Correspondence Solicited.

METALS.

Manufacturer, Smelter, Refiner and Dealer in All Kinds of Metals.

407 CUYAHOGA BLDG., CLEVELAND, O.

A large and growing circulation among machine shop and foundry firms, has THE IRON TRADE REVIEW

Malleable Iron Castings, Elevators and Conveyors, Detachable Sprocket Chain, Sprocket Wheels.

SPROCKET CHAIN MFG. CO.,

Succeeding Detroit Sprocket Chain Co., Ltd.

DETROIT, MICH.

WRITE FOR NEW CATALOGUE.

received orders for 41 engines, including 22 for the Chicago & Alton and 11 for the Lake Shore.

The price paid by Susquehanna Iron & Steel Co. for the Columbia, Pa., rolling mill was $380,000, for the Columbia Iron Co.'s works $170,000, and for the Susquehanna Iron Co.'s works $165,000. The Susquehanna Iron & Steel Co. has also acquired the Aurora Furnace at Wrightsville, Pa., and the York, Pa., rolling mill.

Chas. H. Schaffer, of Marquette, Mich., who has operated Excelsior charcoal furnace at Ichpeming, for many years, and Noah W. Gray, formerly of the Ashland Iron & Steel Co., Ashland, Wis., are repairing Carp charcoal furnace at Marquette, Mich., and expect to put it in blast in early fall.

The Virginia Iron, Coal & Coke Co., has purchased the mineral lands of the Big Stoney Mining Co., at Interior, Va., also the Big Stoney railroad, which runs from Interior to Ripplemead, 12 miles.

First Excursion of the Season

To Atlantic City, N. J., will be run by the C. T. & V. R. R. (B. & O. System), on August 3rd, 1899. Very low round-trip rate, with stop over privilege at Washington, Baltimore and

U. BAIRD MACHINERY CO.,

423-425 Water St., **PITTSBURG, PA.,** 124-126 First Ave.

Machine Tools and Supplies. Send for list of Second-hand Tools.

THE BEST AND THE CHEAPEST.

BRIER HILL PORTLAND CEMENT.

The Brier Hill Iron & Coal Co.,
YOUNGSTOWN, O.

KENTUCKY FIRE BRICK WORKS.

CUPOLA BRICK. STEEL WORKS BRICK.

KENTUCKY FIRE BRICK WORKS, PORTSMOUTH, O. HIGH GRADE FIRE BRICK BEST BLAST FURNACE & ROLLING MILL BRICK

FIREBRICK, KY.

Ore and Coal Handling Machinery

For Blast Furnaces, Docks and Mines.

MINING MACHINERY,
HIGH GRADE HOISTING ENGINES.

WEBSTER, CAMP & LANE MACHINE CO., Akron, Ohio.

P & B PAINT

The best preservative for IRON AND WOOD work exposed to moisture or the actions of acids, alkalies, coal-gas, etc. Contains no oil or tar. Is durable, penetrating and elastic. Of special value for coating roofs, stacks, tanks, vats, etc.....

Write for prices and further particulars.

THE STANDARD PAINT COMPANY
SOLE MANUFACTURERS
NEW YORK: 81-83 John Street
CHICAGO: 189 Fifth Avenue

Conestoga Building, **EDWARD E. ERIKSON,** PITTSBURG, PA.
Regenerative Gas Furnaces and Water Seal Gas Producers.
Producer Gas under Tubular Boilers, saving 20 per cent in fuel. NO SMOKE.

FIRE BRICK.

BRANDS:
O. K. CROWN.
O. K.
A.

SUITABLE FOR
Furnace, Malleable, Mill, Foundry and Lime Kiln Work.

OAK HILL FIRE BRICK AND COAL CO.,
OAK HILL, OHIO.

Persistence In Advertising

Is one of the requisites of satisfactory results. In the expansion of business which is now noticeable in every section of the country, advertisers who have made themselves regularly prominent in the past two years will be first to reap the rewards of persistent publicity

PHOENIX HORSE SHOES—ARE THE BEST HORSE SHOES MADE

CATALOGUE SENT ON REQUEST.

PHOENIX HORSE SHOE CO., POUGHKEEPSIE, N. Y.—JOLIET, ILL.

Philadelphia. Consult agents C. T. & V. R. R., or address J. E. Galbraith, Traffic Manager, Cleveland, O.

RETURN LIMIT EXTENDED.

Seashore Excursion Tickets Via Pennsylvania Lines Good Fifteen Days Returning.

The return limit on the low fare excursion tickets to Atlantic City, Cape May, Avalon, Anglesea, Holly Beach, Ocean City, Wildwood, Sea Isle City, New Jersey, Rehoboth, Delaware, and Ocean City, Md., to be sold Aug. 10th, from principal stations on the Pennsylvania Lines will be Fifteen Days, including date of purchase. This is a longer limit than that granted on similar tickets sold in previous seasons, and will be ample for a delightful sojourn at the seaside. The extreme return limit will be Aug. 24th, which will allow a week after returning home to prepare for school and other duties which begin with the opening of September.

The date of the excursion, Aug 10th, is the most convenient for an outing. Business is quiet at this season, crops are gathered, and office, store and farm duties are not exacting. The thermometer usually reaches the highest point about this time. It will be a pleasing diversion to spend a week's vacation in the invigorating ocean breeze and experience the unlimited pleasures at the command of the summer idler by the sea.

The round trip rate from Cleveland will be $13.50. Tickets at this exceptional low fare may be secured to either of the ten resorts mentioned above, which are the most attractive along the Atlantic coast. For illustrated descriptive matter about them apply to C. L. Kimball, Assistant General Passenger Agent, Cleveland, O.

GET THE BEST

AND YOU

GET THE CHEAPEST

PYRO PAINTS

(PATENTED DECEMBER 1, 1891.)

THEY ARE

GUARANTEED

TO BE

EQUAL IN DURABILITY TO FIVE TIMES THAT OF ANY OTHER ON ANY EXPOSURE, OR MONEY REFUNDED.

Especially Adapted to Use on Locomotive Front Ends, Roofing, Structural Iron or Wood Work, Bridges, Tanks, Piling Under Fresh or Salt Water, etc.

IT IS FIRE, WATER, ACID, WORM, INSECT, AND BARNACLE PROOF.

SEND FOR QUANTITY PRICES, TESTIMONIALS, ETC.

"Roofing covered with Shearer's Patent Pyro Paint, in Winfield, Kan., 14 years ago, is still all right—both metal and wood. The best paint on earth."—B. F. Wood, for seven years a member of School Board. [Mr. Wood refers to any bank in Winfield.

"We have never yet found any paint except the Shearer-Peters Pyro that would stand the combination of heat and steam such as our works are subjected to."—Wm. N. Morgan, Superintendent Crozer Iron Co.

BRANCHES:

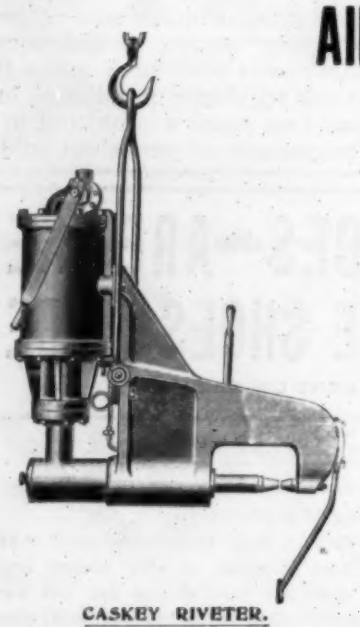
BOSTON—Towle, Barton & Senter, Managers.
NEW YORK—George L. Smith, Manager.
NORFOLK, Va., Pyro Paint Co.
SAN FRANCISCO—John B. Seivers, Manager.
ST. LOUIS, MO.—WITHCOMB & FLOTO, Mgrs.

MADE ONLY BY

THE SHEARER-PETERS PAINT CO.,

CINCINNATI, OHIO, U. S. A.

PEDRICK & AYER CO., PHILADELPHIA, PA.



CASKEY RIVETER.

AIR COMPRESSORS,

Compressed Air Riveters,

HOISTS, CRANES and other Tools.

For Shop, Yard and Foundry Use.

OUR NEW LINE OF CASKEY PNEUMATIC RIVETERS comprise several styles and sizes, and are adapted for any kind of work. These RIVETERS secure the maximum pressure on a rivet with as little weight in the machine as possible. They work rapidly, without jar or shock, and give a uniform pressure on every rivet.

Special Styles Built to Order.

SEND FOR CATALOGUE.

MANNING, MAXWELL & MOORE, Sole Sales Agents.

85-87-89 Liberty Street, New York.

Chicago: 22-24-26 S. Canal St. Pittsburgh: Park Building. Cleveland: 26 S. Water St.

MECHANICAL DRAFT

INDUCED OR FORCED.

When properly installed and using cheap fuels great saving can be made in Fuel Bills.

Has the advantage of close regulation as well as the greatest variation in draft when called for.

TYPE OF INDUCED DRAFT.

We plan and install complete plants with

Sturtevant SPECIAL Steam Fans.

TYPICAL PLANT FOR FORCED DRAFT.

B. F. STURTEVANT CO., Works: BOSTON, MASS.

WAREROOMS: 34 Oliver St., Boston, Mass.
131 Liberty St., New York, N. Y.
16 South Canal St., Chicago, Ill.
135 North Third St. Philadelphia, Pa
75 Queen Victoria St., London, E. C., Eng.
21 W. Nile St., Glasgow, Scotland.
4 Neue Promenade, Berlin, Germany.
2 Kungsholmstorg, Stockholm, Sweden.

The Chicago & North-Western Railway

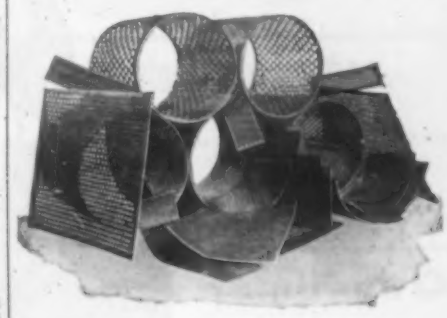
REACHING with its 7,900 miles of road the famous Water Powers, Coal Fields, Iron Ore Ranges, Hard and and Soft Lumber Districts ocated in Illinois, Wisconsin, Michigan, Iowa, Minnesota, South Dakota, North Dakota, Nebraska and Wyoming, and by traffic arrangements with other railways, 7,350 stations located on 41,000 miles of railroad (one-ninth of the entire railroad mileage of the world, and one-fourth of the railroad mileage of the United States), has on its line more industries than any other western railroad.

Manufacturers contemplating moving or establishing branch factories in the West are requested to inquire what we can offer them before going elsewhere.

M. HUGHITT,
General Freight Agent,
CHICAGO.

FRASER & CHALMERS,

143 Fulton Street,
CHICAGO, ILL.



Perforated Metals, Comet Rock Crushers, Mining and Ore Treating Machinery.

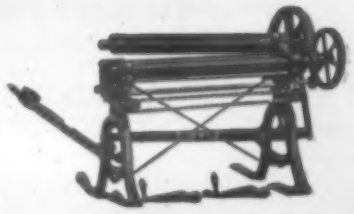
Machines for Working Sheet Metal

Patent Gap Shears.

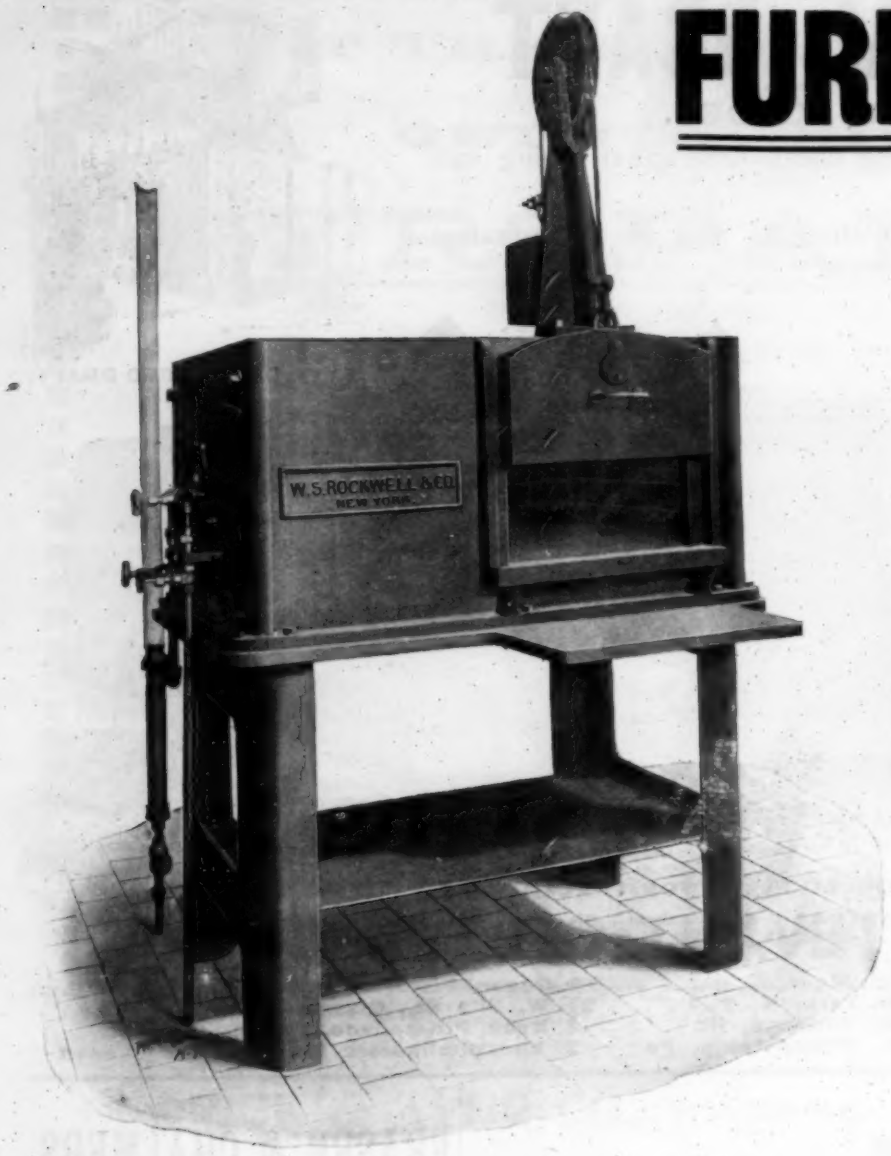
General Purpose Punch and Shear—seven sizes.
General Purpose Forming Rolls—all sizes.
Tools for Boiler Shops, Machine Shops and general iron manufacturing industries.

Address

BERTSCH & CO., Cambridge City, Ind.



FURNACES.



Oil Furnaces,
Coal Furnaces,
Gas Furnaces.

We build them for every purpose
We guarantee they will do the work

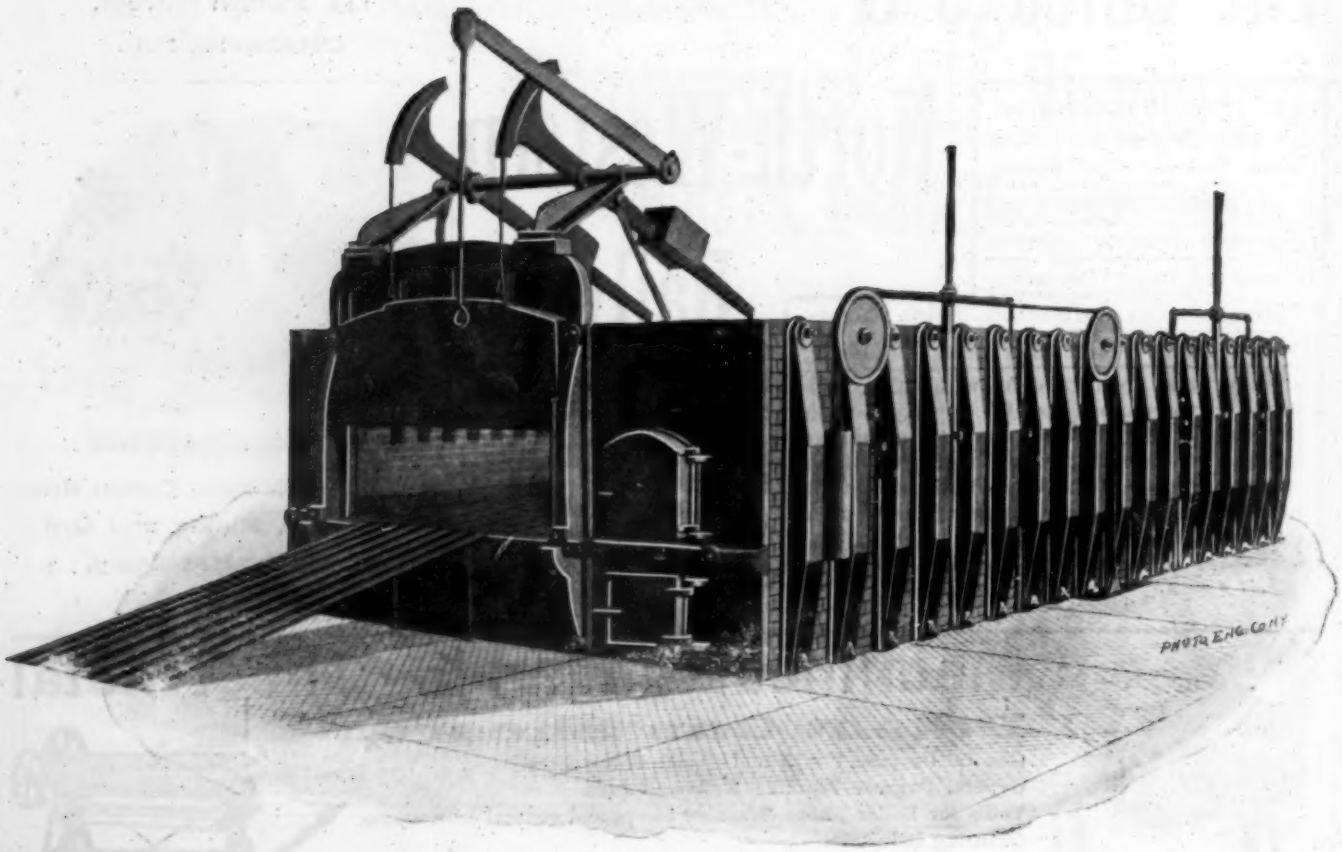
Fuel Oil Burning Appliances...

Installed by us will give
perfect satisfaction....
Write for Catalogue A.

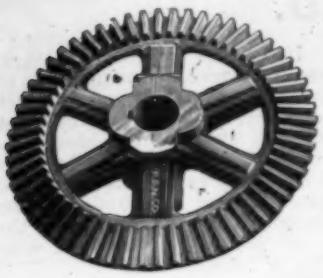
W. S. ROCKWELL & CO.,

26 Courtland St.,

NEW YORK.



BEVEL GEARS



with perfectly correct teeth cannot be cast or turned up with ordinary machines.

We plane the teeth in gears we handle, and guarantee them theoretically correct. Our machinery enables us to turn out such bevels up to eight feet in diameter.

We would like to have your work and solicit correspondence.

R. D. NUTTALL CO., Allegheny, Pa.

Gears and Pinions

SPUR GEARS,
SPIRAL GEARS,
BEVEL GEARS,
WORMS and RACKS.

We make Gears of Steel, Malleable Iron, Cast Iron, Brass and Rawhide, and furnish them complete or cut as desired.

Gear Cutting of all Descriptions.

Material and workmanship the best.
Write us for estimates and prices.

THE VAN DORN & DUTTON CO.
1796 East Madison Ave., Cleveland, Ohio.

WANTED!

Position as traveling salesman for machinery manufacturer. Willing to accept moderate salary. Familiar with beet sugar, rolling mill or hydraulic machinery.

Address,

SALESMAN.
Care IRON TRADE REVIEW,
CLEVELAND, O.

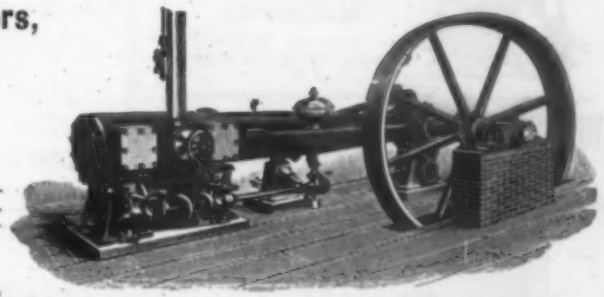
THE I. & E. GREENWALD CO.

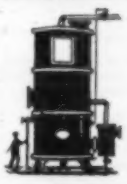
Engineers, Founders, and Machinists.

Steam Engines, Shafting, Hangers, Pulleys, Sprocket Wheels, Chains, Etc.

Headquarters for Mill Gearing of all kinds and sizes. Steam power plants complete.

720 East Pearl St.,
CINCINNATI, OHIO.





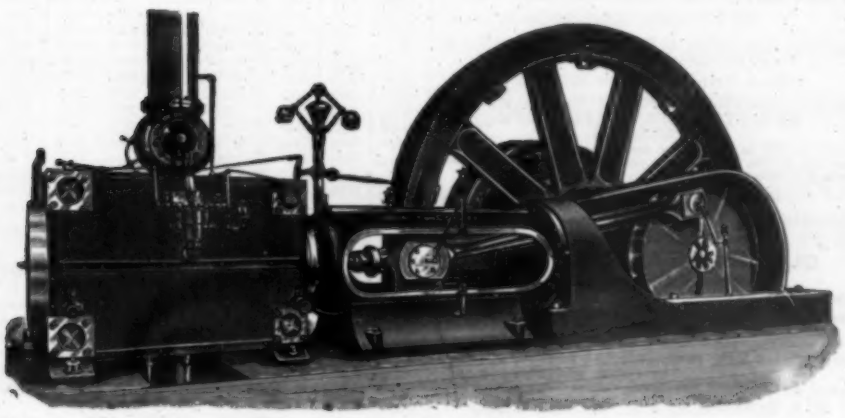
Pittsburg Feed Water Heaters and Purifiers,

(Schlieper Patents).

Sweet's Steam Seperators, Ashton Pop Safety Valves, and Steam Gauges, Bonar Oil Filters, Bona Gauge Cocks, Steam Appliances of all Kinds.

JAMES BONAR & CO., 1116 Carnegie Bldg., Pittsburg, Pa.

THE HOOVEN, OWENS & RENTSCHLER CO., Hamilton, O.



Hamilton Corliss Engines.

Engines for Rolling Mills Electric Railways and Electric Light.

Engines of all Sizes and for all purposes.

46 South Canal St., CHICAGO.
39 and 41 Cortlandt St., NEW YORK.
Lewis Block, PITTSBURGH, PA.
Room A, Laclede Building, ST. LOUIS, MO.
C. C. MOORE & CO., SAN FRANCISCO, CAL.

EVERYTHING IN RUBBER.

Cleveland Tool & Supply Co.,
AGENTS
Boston Woven Hose & Rubber Co.

Punches, Dies, Metal Stamping

IN
STEEL, BRASS, COPPER, ALUMINUM, GERMAN SILVER, ETC.

Send sample or sketch for prices. Novelties and patented articles made by contract.

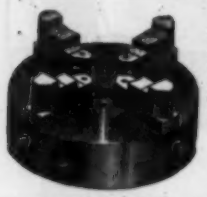
E. KONIGSLOW & BRO.,
310-312 Seneca St., Cleveland, O.

MACHINERY FOR REDUCING AND POINTING WIRE

By Compression or Cold Swaging.

Especially adapted to Pointing Wire Rods and Wire for Drawing. For machines or information, address

S. W. GOODYEAR.
Waterbury, Conn.

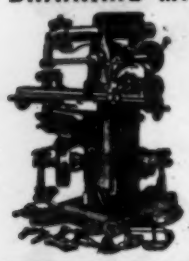


SKINNER CHUCKS.

Independent and Universal Chucks, Combination Lathe Chucks, with pi reversible jaws, Drill Chucks, Planer Chucks and Face Plate Jaws. Send for Catalogue.

SKINNER CHUCK CO.
New Britain, Conn
Chas. H. Besley & Co., 10 N. Canal St., Chicago, Ill.

BRAINARD MILLING MACHINES



Standard, Universal and Plain.
ALSO
LONG FEED MILLING MACHINES.

Brainard Milling Machine Co.
160 Oliver St., BOSTON.
12 So. Canal St., CHICAGO.
77 St. Clair St., CLEVELAND.

THE W. P. DAVIS MACHINE CO.,

ROCHESTER, N. Y.

BUILDERS OF THE CELEBRATED
DAVIS
KEY SEATER
AND
CUTTING OFF MACHINES.
ALSO
ENGINE LATHES,
From 10 to 30 inch swing.
Send for Catalogue.

Our Method
OF
Removing Oil

From feed water returned to boilers, from surface condensers, prevents the burning of tubes and plates.

THE WE FU GO COMPANY,
SMITH AND AUGUSTA STS.,
CINCINNATI, O.

When writing to advertisers please mention The Iron Trade Review.

ANOTHER STEP AHEAD.

You probably use our Riveting Machines. If not, you have heard of them, and also that some of the most prominent manufacturers are using many of them, one company using forty. We have just brought out a new model with many improvements. The speed has been increased 50 per cent and the weight of the reciprocating parts not useful in striking the blow very much reduced. Each 100 units of useful work in the old machine becomes 225 units in the new one. Result, increased efficiency as follows: in speed 50 per cent—in dynamic force of blow 125 per cent—and the strain on the wearing parts of the machine very much reduced. The old machine did the work of four operatives. What will the new one do? 1500 blows per minute. Built in six sizes for rivets from 1-16″ to ½″ diameter.

THE F. B. SHUSTER COMPANY,
Formerly JOHN ADT & SON, Rock St., New Haven, Conn.

Water, Gas and Steam Fitters' Tools.

No. O Threading Machine. Power Attachment.

"ARMSTRONG"
ADJUSTABLE STOCKS AND DIES,
Vises (hinged), Improved Wrenches, Pipe Cutters, Clamp Dogs, Etc.

Improved Pipe Threading and Cutting-off Machines,
HAND OR POWER.

Our No. O machine is designed for threading the smaller sizes of pipe—iron or brass—also bolts. Has two speeds: one for pipe ⅛ to 1 in., the other for pipe 1¼ to 2 in. inclusive.

The Armstrong Mfg. Co.,
BRIDGEPORT, CONN.

Our catalogue will interest you
New York Office, 139 Center St.

A TRIAL ORDER WILL CONVINCE YOU

That we make good Balls for the bearings of machinery, and that every claim we make for them is true. Every Ball we make is made from the best tool steel, is perfectly round and smooth, and highly polished. Every Ball we make is of exactly the same quality, and all of a given size are as near alike as human skill can make them.

We want a trial order, because our experience has been that trial orders bring repeat orders, almost as surely as night follows day.

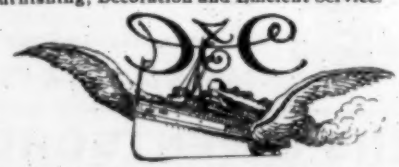
Write us for prices, and ask questions.

CLEVELAND BALL & SCREW CO., Cleveland, Ohio.

For a Summer Cruise . . . take the
Coast Line to MACKINAC.

NEW STEEL PASSENGER STEAMERS, SPEED, COMFORT AND SAFETY.

The greatest Perfection yet attained in Boat construction: Luxurious Equipment, Artistic furnishing, Decoration and Efficient Service.



To DETROIT, MACKINAC, GEORGIAN BAY, PETOSKEY, CHICAGO.

No other line offers a Panorama of 460 miles of equal variety and interest.

Four Trips Per Week Between
TOLEDO, DETROIT AND MACKINAC, PETOSKEY, "THE SOO," MARQUETTE AND DULUTH.

LOW RATES to Picturesque Mackinac and Return, including Meals and Berths. Approximate Cost from Cleveland, $17; from Toledo, $14; from Detroit, $12.50.

Every Day and Night between
Cleveland, Put-in-Bay and Toledo.
Day and Night Service between
CLEVELAND AND DETROIT,
Fare, $1.50 each Direction.
Berths, 75c., $1. Stateroom, $1.75

Connections are made at Cleveland with Earliest Trains for all points East, South and Southwest, and at Detroit for all points North and Northwest.

Sunday Trips May, June, July and August, September and October only.

Send 2c. for Illustrated Pamphlet. Address
A. A. SCHANTZ, G. P. A., DETROIT, MICH.
Detroit and Cleveland Navigation Company

Cleveland, Lorain & Wheeling,

Railroad Company.

Time Table effective May 15th, 1898.

Cleveland Depot: Foot of South Water Street.
Elyria Depot: Huron St., West Side.

South Bound.			Central Standard.		North Bound.	
15	13	11	Lorain Branch	12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling	6:48	10:12	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport	.....	6:05	1:40
.....	8:25	.....	Bellaire	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

Trains 1, 2, 5 and 6 daily between Cleveland and Urichsville. All other trains daily except Sundays. Electric cars between Bridgeport and Wheeling, and Bridgeport and Martins Ferry and Bellaire. Consult agents for general information as to the best routes and passenger rates to all points. M. G. CARREL, G. P. A.,
Hickox Bldg., Cleveland, O.

THE KING IMPROVED SAND BLAST.

The No. 1 machine for cleaning light and ornamental castings, and No. 2 for cleaning large or heavy castings, rolls, gears, bath tubs and for removing paint or rust preparatory to repainting. They do the work quickly, cheaply and thoroughly. It will pay you to look into its merits. Address

THE KING IMPROVED SAND BLAST CO.,
Station C, DETROIT, MICH.

SHEET AND **BLACK PLATE BARS.** All Sizes of **MERCHANT BAR.**

SOFT STEEL BARS, BILLETS, SHEETS, TIN & TERNE PLATE

Light Rails, Hexagons, Channels, Angles, Tees & Special Shapes

Black, Painted, Galvanized—Sheets, Plain and Formed.—Corrugated,—Crimped & other forms of ROOFING.

COMMON AND **SPECIAL SHEETS.** **Tin and Terne Plate** In All Grades.

ÆTNA-STANDARD IRON & STEEL CO., Bridgeport, O.

Oglebay, Norton & Co.,
LAKE SUPERIOR IRON ORES.
— AGENTS —
The Spanish-American Iron Co.,
Santiago, Cuba.
CLEVELAND. PHILADELPHIA.

THE OHIO STEEL COMPANY,
MANUFACTURERS OF
Steel Rails, Billets,
Sheet and Tin Plate Bars.
YOUNGSTOWN, OHIO.

M. A. HANNA & CO.

IRON ORE,
PIG IRON AND COAL.

CLEVELAND, OHIO.

McKEEFREY & CO.,

PIG IRON,
COAL AND COKE.

LEETONIA, OHIO.

Drake, Bartow & Co.
IRON ORES.
515-516 Perry-Payne Building,
CLEVELAND.

STRIKES THE CENTER

BECAUSE NOTHING BUT THE BEST MATERIAL IS USED "HONESTY IS THE BEST POLICY." TO MAKE GOOD CASTINGS, USE THE BEST IRONS.

CLINTON AND HECTOR
Inspected Foundry Irons
—FOR—
SOFTNESS, STRENGTH, FLUIDITY, UNIFORMITY.
MANUFACTURED BY
CLINTON IRON & STEEL CO.
FURNACES: Pittsburgh, Pa. NEW YORK OFFICE: No. 15 Cortlandt St.

CLEVELAND ROLLING MILL CO.,
CLEVELAND, - OHIO,
—MANUFACTURERS OF—
BESSEMER AND OPEN-HEARTH STEEL,
Blooms, Billets, and Slabs, Steel Rails, Steel Beams, Channels and Angles. Steel Forgings, Bar Spring, and Sleigh Shoe Steel. Steel Wire of all kinds. Barbed Wire, Iron and Steel Plates, Galvanized and Black Sheet Iron and Steel Corrugated Iron Roofing.

LAKE SUPERIOR CONSOLIDATED IRON MINES.
HIGH GRADE MISSABE ORES.
Adams, Ainslie, Duluth, Hibbing, Hartley, Linwood and Pillsbury Mines.
OGLEBAY, NORTON & CO., Sales Agents - Cleveland, Ohio.

E. A. DELANO,
50 to 52 So. Clinton St., Chicago.
MANUFACTURER OF
SHAFTING, PULLEYS & HANGERS.
A Large Stock Constantly on Hand.
CORRESPONDENCE SOLICITED.

Pickands, Mather & Co.,
IRON ORE, PIG IRON AND COAL - - -
CLEVELAND, OHIO.

The Iron Trade Review is an increasingly valuable medium, through which to sell equipments to machine shop and foundries.

THE READING STANDARD BLOCK.

PATENTED.

This is the latest addition to our line of Chain Blocks. It is high in efficiency, has an adjustable automatic brake sustaining the load at any point of the lift, hoists and lowers rapidly, and being light and compact, can easily be taken from place to place.

TRAVELING CRANES, OVERHEAD TRACKS, ETC.

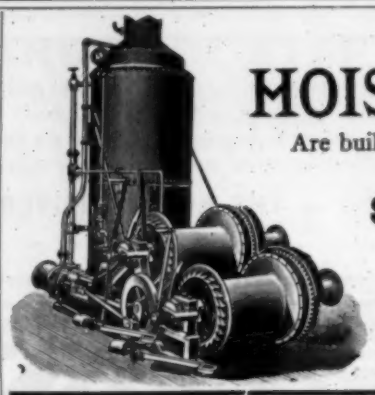
Reading Crane & Hoist Wks.,
Reading, Pa.

LINK-BELT . .

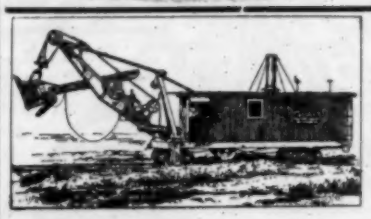
Elevators and Conveyors,

Malleable Buckets, Steel Ash Cars, Shafting, Pulleys, Bearing, Rope Sheaves, etc.,

Link-Belt Machinery Co.
Engineers, Founders, Machinists. . . .
CHICAGO, U. S. A.
Link-Belt Engineering Co.
Phila. and New York.



LIDGERWOOD
HOISTING ENGINES
Are built to Gauge on the Duplicate Part System.
QUICK DELIVERY ASSURED.
STANDARD For Quality and Duty.
Steam and Electric HOISTS.
LIDGERWOOD MFG. CO.,
96 LIBERTY STREET, NEW YORK.
Chicago, Portland, Ore. Cleveland, Boston, Philadelphia, New Orleans.

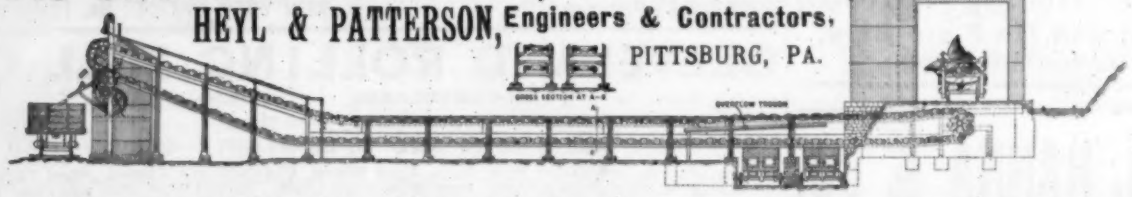


THE BUCYRUS COMPANY,
DESIGNERS AND BUILDERS OF
Dredges, Steam Shovels, Excavating Machinery, Steam and Electric and Locomotive Cranes, Centrifugal Pumps, with Simple, Compound or Triple Expansion Engines, Pile Drivers Wrecking Cars, Placer Mining Machines.
SOUTH MILWAUKEE, WIS.

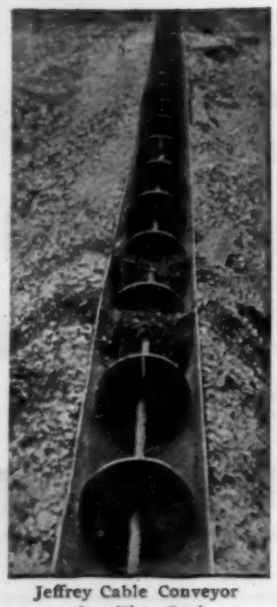
CRANES •HIGH•SPEEDS•
•ELECTRIC•STEAM•HAND•
•MACHINERY FOR HANDLING **COAL** AND **ORE** WORKS
THE BROWN HOISTING AND CONVEYING MACHINE CO CLEVELAND, O.
NEW YORK 26 CORTLANDT ST • LONDON 39 VICTORIA ST. S.W.

The Chemical Analyses of Iron, $4.00.

PIG CASTING MACHINES,
Complete Installations.
Guaranteed Results.
HEYL & PATTERSON, Engineers & Contractors,
PITTSBURG, PA.



JEFFREY Elevating, Conveying, Power Transmission Machinery.



Jeffrey Cable Conveyor handling Coal.

We solicit an opportunity to help you solve your Coal Handling Problems. Our methods are up-to-date.

Chains (all styles),
Link Belting,
Sprocket Wheels
Rubber Belting,
Spiral Conveyers
Coal Washers,
Coal Mining Machinery, &c

For 1899 catalogue address
The Jeffrey Mfg. Co.
Columbus, O. U.S.A.
NEW YORK, 41 Dey St.

A large and growing circulation among machine shop and foundry firms has THE IRON TRADE REVIEW.

Subscribe for The IRON TRADE REVIEW, $3 per year.

BUCKETS.

We are builders of Car Unloaders, Swinging and Revolving Derricks, Hoisting Engines, Clam Shell Buckets and Cranes.

EXCELSIOR IRON WORKS CO.,
CLEVELAND, OHIO.
Engineers, Founders, Machinists

PERFORATED METALS.

PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.

THE ROBERT AITCHISON. PERFORATED METAL CO.,

OFFICE, ROOM 510 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

STEEL CONSTRUCTION

IN ALL BRANCHES.

BUILDINGS DESIGNED AND ERECTED IN ALL PARTS OF THE WORLD.

Roof Frames and Trusses.
Blast Furnaces and Steel Works,
Cupolas, Ladles, Converters,
Boilers, Tanks and Heavy Plate Work

RITER-CONLEY MFG. CO., PITTSBURG, PA.

THE AMERICAN PNEUMATIC TOOL CO.

844 Washington St., New York City.

PNEUMATIC TOOLS

For Chipping, Caulking and Beading

If you want a pneumatic tool which will calk a six foot boiler. ⅝ in. stock, 3 courses, all circular and horizontal seams, both heads, and bead all tubes in less than 5 hours with 60 lbs. air pressure. (Kendall & Sons, Cambridgeport, Mass., caulked a six foot boiler to 150 test in 2 hours and forty-five minutes.)

ORDER OUR "F" TOOL.

If you want a tool which will calk up to 1¼ in and will chip ⅜ in x11-16 in. x1¾ per minute order our "G" Tool. We ship on 10 days trial with guarantee.

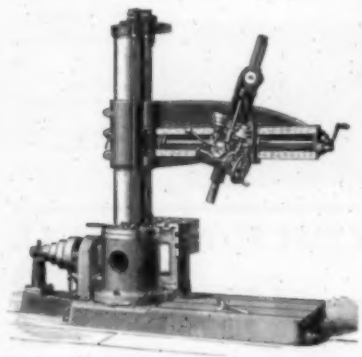
Alex Laughlin & Co., Pittsburg, Pa.

Gas Heating - - -
Gas Puddling - - - -
Open Hearth - - - -
Crucible - - - - - -
Tube - - - - - - -

FURNACES

And Artificial Gas Producers of Every Description for Rolling Mills, Steel and Tube Works.

WE GUARANTEE to place all Plants erected by us in successful operation.



To Pay Dividends,

you need good tools. In the line of drills you can find nothing better than a

BICKFORD RADIAL

Modern, efficient and accurate. **It will Cut Your Cost.**

THE BICKFORD DRILL & TOOL CO.,
Cincinnati, Ohio, U. S. A.

CREMER & BICKNELL, . . Chemists and Metallurgists, . . 24 Superior St., Cleveland, O.

Analytical and Testing Laboratory.

Reports on chemical and metallurgical processes. **Analyses** of ores, metals, fuels, railroad and foundry supplies, etc. **Assaying**—Gold, silver, copper ores. **Mechanical Tests of Iron, Steel,** etc. Our Testing Machine has been standardized by Insp. of Ordnance, U. S. A., for use on government work.

Subscribe for the Iron Trade Review, $3.00 per year.

Le Chatelier's

PYROMETER

For measuring temperatures between 0 and 2900° F.

Recommended by the Highest Authorities.

Successfully used in establishments for the manufacture of

Gas,	Chamotte,
Chemicals,	Cement,
Sugar,	Accumulators,
Terra Cotta,	Incandescent Lamps,
Stone Ware,	Cartridges and Ammunition,
Porcelain,	Glass,

Iron and Steel, Malleable Iron.

Also by Boiler Inspectors, Schools and Colleges, for **hardening and annealing steel in roll foundries,** etc.

VULCAN MFG. CO., Ltd.,
Pittsburg, Pa.
Station D.

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: Steel and Iron Buildings for Rolling Mills, Tin Plate Plants, Steel Works, Foundries, Factories, Roof Trusses, Girders, Columns, Beams, Corrugated Iron, Etc.

Main Office and Works:
48th Street and A.V. Ry., PITTSBURG, PA.

Branch Offices:
1214 Betz Building, Philadelphia, Pa.
45 Broadway, New York, N. Y.
128 Lumber Exchange, Minneapolis, Minn.
1243 Marquette Building, Chicago, Ill.

FOR SALE.

Valuable Furnace Property in Central New York, known as Kirkland Iron Co.

Also 150 acres of ore rights and mines within ½ to 1½ miles of the furnace, all located at Kirkland, Oneida County, N. Y., on the N. Y., Ontario & Western and West Shore Railroads. At Utica, 6½ miles east is the N. Y. Central & Hudson River Railroad and its branches (running north, south, east and west;) the Delaware, Lackawanna & Western Railroad and Erie Canal, while 25 miles west is the Lehigh Valley Railroad. The freight rates to all points are reasonable and ore and fuel cheap. There are about 70 acres of land in connection with the furnace. The property is in good condition and a modern plant. Object in selling is to close an estate. Apply to

IRVIN A. WILLIAMS, 11 Blandina St., Utica, N. Y.

For Sale or Rent.

An up-to-date Plant for the manufacture of Steel Bridges, Structural Work, etc., located on the lines of the Canadian Pacific and Grand Trunk Railways at Peterborough Ontario, where (if desired) Electric Power can be obtained for their operation at a moderate price. As the carrying on of these works is not in the line of the present owners, they are prepared to sell or lease the same upon terms and conditions which will insure to any one having a moderate amount of capital and a thorough and practical knowledge of the business, a rare opportunity of turning the same to profitable account. For further information, address

JOHN CARNEGIE,
Pres. Central Bridge and Engineering Co., Ltd.,
Peterborough, Ontario.

FOR SALE OR LEASE.

A plant suitable for manufacturing in iron and steel. Foundry, machine shops, blacksmith shops, pattern shops, etc., etc., partially equipped and ready for installing machinery. Engines, boilers, shafting and other machinery in place. Substantial brick buildings covering about 6 acres of land. Railroad tracks laid into the grounds connecting with all lines. Local conditions favorable and transportation facilities unexcelled. Will sell or lease to right party on liberal terms. Address A. C. Titus, WestSuperior, Wis.

FOR SALE.

1 Pair of Blooming Reversing Engines, 28 x 48, with Steel Gear Wheels and Shafts. Made in 1894 by Mackintosh-Hemphill & Co., of Pittsburg.

1 Universal Mill, with coupled Reversing Engines; the mill rolls up to 30 inches in width and the top roll has a lift of 10 inches.

1 Five ton Morgan Steam Hammer.

Apply to OLIVER IRON & STEEL CO., Pittsburgh, Pa.

FOR RENT OR SALE.

The Axle Works property at Junction of Broadway, Erie & Valley railways, Cleveland, O., including engine, boiler and shafting; or will erect on these premises buildings to suit tenant, if leased for a term of years. Address

CLEVELAND AXLE MFG. CO.,
Canton, O.
ESTABLISHED 1854.

THE "CLEARFIELD" FIRE BRICK

MANUFACTURED BY

THE CLEARFIELD FIRE BRICK CO., Limited,

Office and Works at CLEARFIELD, PA.

Room 303 Ferguson Bldg., Pittsburg, Pa., John Richardson, Agent.

FIRE DOVER FIRE BRICK CO., MANUFACTURERS OF Furnace, Kiln and Special Shape Fire Brick. Office, 44 Mercantile Bank Bldg., CLEVELAND, OHIO. **BRICK**

FIRE BRICK For All Purposes.

CHICAGO FIRE CLAY PRODUCT CO.,

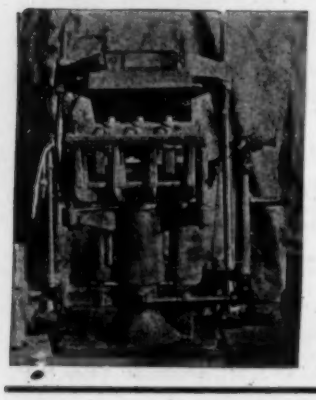
518 Chamber of Commerce, CHICAGO, ILL.

ÆTNA FIRE BRICK COMPANY,

Manufacturers of the Celebrated

ÆTNA HIGH GRADE FIRE BRICK,

Office and Works: OAK HILL, OHIO.



FOUNDRY MOLDING ...MACHINES...

Stripping Plate Machines Operated by Steam or Compressed Air.

Our new air power vibrator machine gives all the advantages of stripping plate work, without the cost of stripping plates.

Write us about low cost of pattern installation. Wood or metal patterns used.

THE TABOR MFG. CO., Elizabeth, N. J.

MILLETT'S PATENT **CORE OVEN**

No one who makes small cores can afford to be without it.

DOUBLE DOORS,

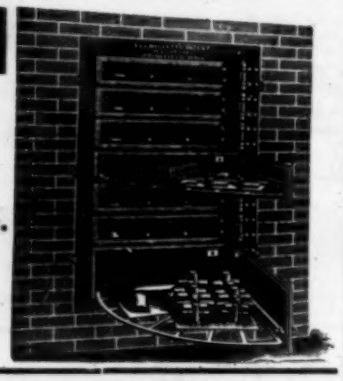
One closing the oven when the other is open.

Saves Fuel, Saves Time.

SEND FOR CIRCULAR.

MILLETT CORE OVEN CO., Brightwood, Mass.

The Core Ovens may be seen in the sample rooms of The S. Obermayer Co., either in Cincinnati or Chicago. J. W. Paxson & Co., Philadelphia, Pa.



FIRE BRICK

Holmes, Strachan & Co.,

Manufacturers and Shippers

Steel
Savage Mountain
Holmes

Best made for Malleable Rolling Mill Furnaces and Cupola Linings.

DETROIT, MICH.

B.F.S.Co's **Flasks** are **All Right** so **Are Prices.**

Send for catalogue if interested

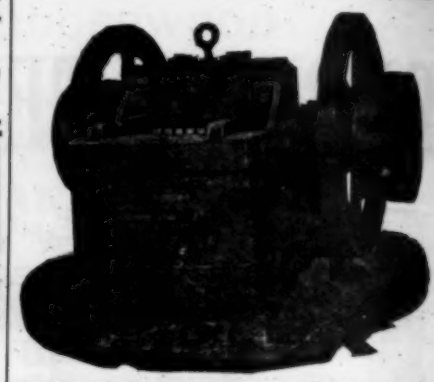
LATEST AND BEST.

Patent No. 580,205.

BE SURE YOU GET THE RIB.

BRASS FOUNDERS' SUPPLY CO., Newark, N. J.

Selling Agents FOR Brass Founders Supply Co.: THE S. Obermayer Co. Cincinnati and Chicago. J. W. Paxson Co. Philadelphia, Pa. J. L. McCormick Co. Pittsburgh, Pa.



THE FARREL (Blake Pattern (Ore and Rock. **---CRUSHER.**

STANDARD OF THE WORLD.

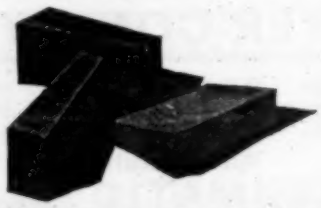
Farrel Foundry and Machine Co.,

EARLE C. BACON, Engineer,

Havemeyer Bldg., NEW YORK.

Fire Brick, Cupola Blocks, Molding Sand and General Foundry Supplies

OF THE HIGHEST GRADE ONLY.



THE GARDEN CITY SAND CO.,

1201-1202-1203 Security Bldg., Chicago.

A. F. SMITH & CO.,

MANUFACTURERS OF

Fire Brick and Clay,

BEAVER COUNTY SAND STONE.

Telephone 42. NEW BRIGHTON, PA.

TRADE MARK SCIOTO

"Royal Star" and "Scioto Star"

High Grade FIRE BRICK.

Best for Rolling Mills, Blast Furnaces, Foundries, etc. High grade Plastic and Flint Clays for all refractory purposes at favorable prices.

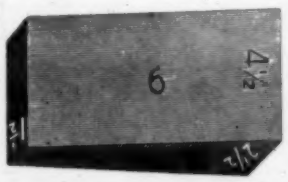
The Scioto STAR Fire Brick Works.

PORTSMOUTH OHIO.

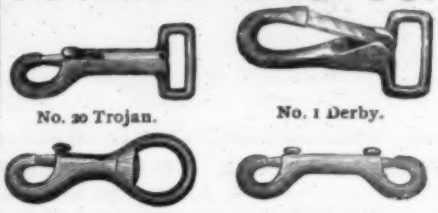
Send for Catalogue

Established 1871.

Incorporated 1876.



COVERT MFG. CO.



No. 20 Trojan. No. 1 Derby.

No. 50 Swivel. 510 Double.

WEST TROY, N. Y.

A large and growing circulation among machine shop and foundry firms has THE IRON TRADE REVIEW.

M. M. COCHRAN, President.
JNO. H. WURTZ, Sec'y & Treas.

J. R. LAUGHREY, Vice-Pres.
J. S. NEWMYER, Manager.

WASHINGTON COAL & COKE CO.

3,500 Acres of Coal.

5,000 Tons Daily Capacity. 350 Individual Coal and Coke Cars.

YOUGHIOGHENY COAL
For Steel Works, Rolling Mills, Tin Plate Works, Locomotive Fuel, etc.

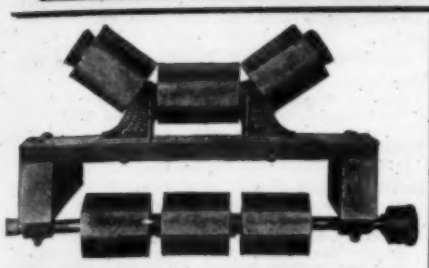
COKING COAL
For Bee Hive or By-Product Ovens.

Our WASHINGTON COKE

Is unsurpassed for uniform purity and general satisfaction in **Blast Furnace and Cupola Practice.** Quality and prompt attention to shipments insure us the preference.

General Office,
DAWSON, FAYETTE CO., PA.

Sales Office, Pittsburg, Pa.,
N. P. HYNDMAN, Sales Agent.



ROBINS BELT CONVEYORS

ARE THE

STANDARD

FOR HANDLING

Ore, Coal, Limestone.

AVOID { Repairs, Shut Downs, Scraping.

Robins Conveying Belt Co.,
147-9 Cedar St., New York.

Press Clippings.

If you want THE BEST THINGS printed on any particular subject or ALL that is published about it everywhere, YOU CAN GET IT FROM US. Clippings mailed daily.

We read practically every newspaper and periodical that is published. Business men and others find our service very valuable to them. Rates, $1 per month and upwards.

Write for particulars.

The Chicago Press Clipping Bureau,
56 Fifth Avenue, CHICAGO.

Sole Makers of RIEDLER PUMPS.

S. FIX SONS'

STEAM TUBE WELDING WORKS.

Manufacturers of reworked boiler tubes
Good second-hand tubes bought.

CLEVELAND, O.

VULCAN TRADE MARK. LUBRICATOR

ESTABLISHED 1884.

Why Use Expensive Oils?

YOU WILL WANT MORE OF

...THE VULCAN LUBRICANT...

AFTER HAVING TRIED IT.

Costs Less than 2 Cents a Gallon.

Not a new article by any means. I can show that I am now supplying and have supplied some very good people for the past 14 years. FULL DESCRIPTIVE CIRCULAR UPON REQUEST.

A. F. BOETTCHER,
Rowlands, Pa.

Air Compressors
for Air Lift Well Pumping.

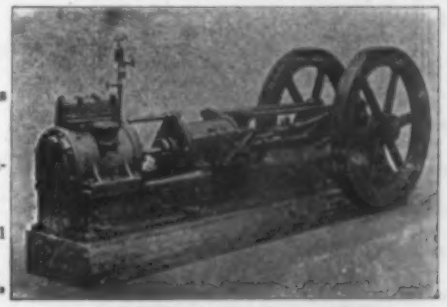
Air Compressors
for Rock Drills, Coal Cutters, Air Hoists and Pneumatic work generally.

Pressure Pumps
for Cotton Oil Mills and Cotton Compressors.

Steam Pumps,
Single and Duplex, of all sizes and for all purposes.

Duplex and Triplex POWER PUMPS.

CORRESPONDENCE SOLICITED.



HALL STEAM PUMP COMPANY. Pittsburg, Pa.

Who builds the best Mine Pump?

PRESCOTT.

Fred. M. Prescott Steam Pump Co.,

MILWAUKEE, WIS.

BRASS FOUNDERS FINISHERS J. J. RYAN & CO.

8874 West Monroe St., Chicago.

Best Bronze, Babbitt Metals, Brass and Aluminum CASTINGS On Short Notice.

Between the Lakes and the Gulf, the Mississippi and the Allegheny Mountains—the best buying section of the United States—is the BULK of THE IRON TRADE REVIEW'S circulation. In this section advertisers in all trade papers get best returns.

BUYERS' DIRECTORY.

Air Compressors—
Edw. P. Allis Co., Milwaukee, Wis.
Rand Drill Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
Clayton Air Compressor Works, New York.
Ingersoll-Sergeant Drill Co., New York.
Hall Steam Pump Co., Pittsburg, Pa.
Manning, Maxwell & Moore, New York City.

Air Lift Pumps—
Clayton Air Compressor Works, New York.
The Ingersoll-Sergeant Drill Co., New York.

Analytical Chemists—
Dickman & MacKenzie, Chicago, Ill.
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O
The Robert W. Hunt & Co., Chicago, Ill.
John T. Jones & Co., Chicago, Ill.
J. Blodgett Britton & Co., Warrenton, Va.
Cremer & Bicknell, Cleveland, O.

Annealing Boxes—
Meehan Boiler & Construction Co., Lowellville, Ohio.

Anti-Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Wm. Cramp & Sons, Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips Sons' Co., Philadelphia, Pa.
Henry L. Schwarzenberg, Cleveland, O.

Babbitt Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Lorain Foundry Co., Lorain, O.
Henry L. Schwarzenberg, Cleveland, O.

Balls—
Cleveland Ball & Screw Co., Cleveland, O.

Bar Iron and Steel—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Bourne-Fuller Co., Cleveland, O.

Bearing Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips Sons' Co., Philadelphia, Pa.
Henry L. Schwarzenberg, Cleveland, O.

Bellows—
The S. Obermayer Co., Cincinnati, O.

Belting—
C. H. Besly & Co., Chicago, Ill.
The Chicago Rawhide Mfg. Co., Chicago, Ill.
The Gandy Belting Co., Baltimore Md.
Cleveland Tool & Supply Co., Cleveland, O.
Main Belting Co., Philadelphia, Pa.

Belt Conveyors.
Robins Conveying Belt Co., New York City.

Belt Lacing—
The Bristol Co., Waterbury, Conn.

Blacksmith and Carriage Supplies—
C. H. Besly & Co., Chicago, Ill.

Black Lead—
The S. Obermayer Co., Cincinnati, O.

Blast Furnace Machinery—
Excelsior Iron Works Co., Cleveland, O.

Blast Furnace Work—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.

Blowers—
B. F. Sturtevant Co., Boston, Mass.

Blowing Engines—
Southwark Foundry & Machine Co., Philadelphia, Pa.

Boilers and Boiler Attachments—
The Wm. B. Pollock Co., Youngstown, O.
Cahall Sales Department, Pittsburg, Pa.
Enterprise Boiler Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
Hooven, Owens & Rentschler Co., Hamilton, O.
Harrison Safety Boiler Works, Philadelphia.
Lane & Bodley Co., Cincinnati, O.
Meehan Boiler & Construction Co., Lowellville, Ohio.
Wm. Cramp & Sons, Philadelphia, Pa.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Excelsior Iron Works Co., Cleveland, O.
James Bonar & Co., Pittsburgh, Pa.
W. P. Davis Machine Co., Rochester, N. Y.

Boiler Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Boiler Covering—
C. H. Besly & Co., Chicago, Ill.

Boiler Compounds—
The Ironsides Company, Columbus, O.

Boiler Fronts and Fittings—
The Lane & Bodley Co., Cincinnati, O.
Playford Stoker Co., Cleveland, O.

Boiler Tubes—
S. Fix Sons, Cleveland, O.
National Tube Works Co., McKeesport, Pa.
Shelby Steel Tube Co., Cleveland, O.,

Boiler Tube Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa

Bolts and Nuts—
Upson Nut Co., Cleveland, O.

Boring and Turning Mills—
H. Bickford, Lakeport, N. H.
U. Baird Machinery Co., Pittsburg, Pa.
Baush & Harris Machine Tool Co., Springfield, Mass.
The Bickford Drill and Tool Co., Cincinnati, O.

Brass Castings—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

Bridges—
Shiffler Bridge Co., Pittsburg.

Buildings (Steel Frame.)—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.

Buckets and Derricks—
Excelsior Iron Works Co., Cleveland, O.

Car Unloaders—
Excelsior Iron Works Co., Cleveland, O.

Carrying Tongs—
Vulcan Mfg. Co., Pittsburg, Pa.

Castings—
Seaman-Sleeth Co., Pittsburg, Pa.
Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Lorain Foundry Co., Lorain, O.
Bethlehem Steel Co., South Bethlehem, Pa.

Castings (Aluminum)—
J. J. Ryan & Co., Chicago, Ill.

Castings (Brass)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co Lorain. O.

Castings (Bronze)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

Casting Cleaners—
King Improved Sand Blast Co., Detroit, Mich.

Castings (Malleable)—
Acme Malleable Iron Works, Buffalo, N. Y.

Cement
The Brier Hill Iron & Coal Co., Youngstown, O
Garden City Sand Co., Chicago, Ill.

Chain Hoists—
Edwin Harrington Son & Co., Philadelphia, Pa.
Reading Crane & Hoist Works, Reading, Pa.

Chain Belting—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
Sprocket Chain Mfg. Co., Detroit, Mich.

Channelers—
The Ingersoll-Sergeant Drill Co., New York.

Charcoal—(Lump, powdered, granulated)—
The S. Obermayer Co., Cincinnati, O.

Chemists—
Dickman & MacKenzie, Chicago, Ill.
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
John T. Jones & Co., Chicago, Ill.
J. Blodgett Britton & Co., Warrenton, Va.
Cremer & Bicknell, Cleveland, O.
We Fu Go Co., Cincinnati, O.

Chilled and Sand Rolls—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Riverside Foundry Co., Cleveland, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips Sons' Co., Philadelphia, Pa.
Lorain Foundry Co., Lorain, O.

Chucks—
Skinner Chuck Co., New Britain, Conn.

Coal Cutters—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.

Coal Screens—
Rob't. Aitchinson Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.

Coal and Coke—
Forster, Waterbury & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Washington Coal and Coke Co., Pittsburg, Pa.
Pickands, Mather & Co., Cleveland, O.

Coal Handling Machinery.
Robins Conveying Belt Co., New York City.

Coal Mining Machinery—
Jeffrey Mfg. Co., Columbus, O.
Webster Camp & Lane Machine Co., Akron, O.

Conveyors—
Jeffrey Mfg. Co., Columbus, O.
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

Comparometers—
Vulcan Mfg. Co., Pittsburg, Pa.

Compressed Air Shop Tools—
Clayton Air Compressor Works, New York City.
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Q & C Co., Chicago, Ill.
American Pneumatic Tool Co., New York City.
Manning, Maxwell & Moore, New York City.

Compression Couplings—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

Contractors for Cleaning Boilers—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Core Ovens—
Millett Core Oven Co., Brightwood, Mass.

Corrugated Iron—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Cranes and Derricks—
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
Edwin Harrington, Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Excelsior Iron Works Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

Crucibles—
Henry L. Schwarzenberg, Cleveland, O.

Cupolas—
Riter-Conley Mfg. Co., Pittsburg, Pa.

Dies—
Danielson Machine & Tool Co., Cleveland, O.

Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.

Drill Grinders—
J Wendell Cole, Columbus, O.

Drill Presses—
W. P. Davis Machine Co., Rochester, N. Y.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington, Son & Co., Philadelphia.
Bickford Drill & Tool Co., Cincinnati, O.
Cleveland Tool & Supply co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield Mass.
Manning, Maxwell & Moore, New York City.
Danielson Machine & Tool Co., Cleveland, O.

Drop Forgings—
Wyman & Gordon, Worcester, Mass.

Drop Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co , Cleveland, O.

Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.

Dry Kilns—
B. F. Sturtevant Co., Boston.

Dynamos—
Jeffrey Mfg. Co., Columbus, O.

Eave Troughs and Conductors—
Berger Mfg. Co., Canton, O.

Elevators—
The Lane & Bodley Co., Cincinnati, O.

Elevating and Conveying Machinery—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Lidgerwood Mfg. Co., New York City.
The Aultman Co , Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O'
Sprocket Chain Mfg. Co., Detroit, Mich.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

Emery and Corundum Wheels—
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland. O.
W. P. Davis Machine Co., Rochester, N. Y.

Emery Wheel Machinery—
J. Wendell Cole, M. E., Columbus, O., or Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.
Cleveland Tool & Supply Co., Cleveland, O

Engineers and Contractors—
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co., Lowellville Ohio.
H. E. Erickson, Pittsburg, Pa.
John T. Jones & Co., Chicago, Ill.
Riter-ConleyMfg. Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.

Engine Packing—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.

Engineers' Supplies—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

Engine Lathes—
U. Baird Machinery Co., Pittsburg, Pa.

Engines (Oil)—
The Aultman Co., Canton, O.

Engines (Steam)—
W. P. Davis Machine Co., Rochester, N. Y.

Wm. Tod & Co., Youngstown, O.
B. F. Sturtevant Co., Boston, Mass.
The Edward P. Allis Co,, Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.
I. & E. Greenwald Co., Cincinnati, O.
Webster Camp & Lane Machine Co., Akron, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

Engravers and Electrotypers—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,
Samuel R. Mason, Cleveland, O.

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt.Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland. Pa.
F. B. Stevens, Detroit, Mich.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flexible Shafts—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Flue Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa.

Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus. O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & E. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.

Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland. O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.
Henry L. Schwarzenberg, Cleveland, O.
King Improved Sand Blast Co., Detroit, Mich.

Foundry Facings—
Cleveland Facing Mill Co., Cleveland, O.

Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Braeburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.

Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Henry L. Schwarzenberg, Cleveland, O.

Furnaces—
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Fuel Oil Burners—
W. S. Rockwell & Co., New York City.

Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizers—
Ætna-Standard Iron & Steel Co., Bridgeport, O
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.

Gauge Cocks—
James Bonar & Co., Pittsburg, Pa.

Gearing.
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutting—
The R. D. Nuttall Co., Allegheny, Pa.
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.

Gear Lubricants—
The Ironsides Company, Columbus, O.

Grease—
A. F. Boettcher, Rowlands, Pa.

Grindstones—
C. H. Besly & Co., Chicago, Ill.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,

Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.

Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O
Brass Founders' Supply Co., Newark, N. J.

Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

Hangers—
R. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.

Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.

Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.

Heavy Hardware—
C. H. Besly & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O.

Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
Excelsior Iron Works Co., Cleveland, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Co., New York City.

Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.

Hotels—
United States Hotel Co., Cleveland, O.

Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Impulse Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Ingot Molds—
Lorain Foundry Co., Lorain, O.

Injectors—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct

Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co.,Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

Iron Working Tools—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Ball & Screw Co., Cleveland, O.
W. P. Davis Machine Co., Rochester, N. Y.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

Ladles—
The S. Obermayer Co., Cincinnati, O.

Lathes—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

Lubricators—
A. F. Boettcher, Rowlands, Pa.

Machinery Name Plates—
August Becker, Boston, Mass.

Machinists' Tools and Supplies—
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Western Mfg. Co , Springfield, O.

Machine Screws—
C. H. Besly & Co., Chicago, Ill.

Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
H. A. Streeter, Chicago, Ill.

Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Braeburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Malleable Castings—
Acme Malleable Iron Works, Buffalo, N. Y.

Manufacturing Chemists.
We Fu Go Co., Cincinnati, O.

Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.

Metal Bearings—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Henry L. Schwarzenberg, Cleveland, O.

Milling Machines—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Brainard Milling Machine Co., Hyde Park, Mass
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, NewYrok City.

Mining Machinery—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

Mine Pumps—
F. M. Prescott Steam Pump Co.,Milwaukee,Wis.

Molding Machines—
Tabor Mfg. Co., Elizabeth, N. J.

Molding Sand—
Ohio Sand Co., Conneaut. O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Multiple Drills—
Bickford Drill and Tool Co., Cincinnati, O.

Name Plates—
August Becker, Boston, Mass.

Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.

Nuts and Bolts
Upson Nut Co., Cleveland, O.

Oilless Bearings—
C. H. Besly & Co., Chicago, Ill.

Oil Burners—
W. S. Rockwell & Co., New York City.

Oil Cups—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

Oil Filters—
James Bonar & Co., Pittsburg, Pa.

Oil Pumps—
C. H. Besly & Co., Chicago, Ill.
Oil Separators—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Packing—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York, City.
The Shearer-Peters Paint Co., Cincinnati, O.
Pattern Works—
Gobeille Pattern Co., Cleveland. O.
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co , Cleveland, O.
Pipe Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Pipe Covering—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.
Planers—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.
Pneumatic Appliances—
Clayton Air Compressor Works, New York.
Pneumatic Tools—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago. Ill.
Portable Forge—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago. Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago. Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Punches—
E. Konigslow & Bro. Cleveland, O.
Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.
Radial Drills—
Bickford Drill and Tool Co., Cincinnati, O.
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Rivets—
Champion Rivet Co., Cleveland, O.
Jonse & Laughlins, Ltd., Pittsburg, Pa.
Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.
Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Rolling Mill Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa'
Roofs—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Sand Blast Machines—
King Improved Sand Blast Co., Detroit, Mich.
Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.
Saws—
Peter Gerlach & Co., Cleveland, O.
Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill
Screw Machines—
Cleveland Ball & Screw Co., Cleveland, O.
Seamless Tubes—
Shelby Steel Tube Co., Cleveland, O.
Separators—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
Shafting—
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Shapers—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.
Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.
Special Machinery—
Edwin Harrington Son & Co., Philadelphia.
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Stand Pipes—
The Wm. B. Pollock Co., Youngstown, O.
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.
Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.
Steam Packing—
C. H. Besly & Co., Chicago, Ill.
Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Steam Separators—
James Bonar & Co., Pittsburg, Pa.
Austin Separator Co., Detroit, Mich.
Harrison Safety Boiler Works, Philadelphia, Pa.
Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Steam Specialties—
C. H. Besly & Co., Chicago. Ill.
James Bonar & Co., Pittsburg, Pa.
Steel—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Brœburn Steel Co., Brœburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Steel Balls—
Cleveland Ball & Screw Co., Cleveland, O.
Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
Steel Plants—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.
Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Steel Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland, O.
Steel Tubes—
Shelby Steel Tube Co., Cleveland, O.
Stokers—
Playford Stoker Co., Cleveland, O.
Tanks—
Enterprise Boiler Co., Youngstown, O.
Meehan Boiler & Construction Co., Lowellville, O
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Tank Cars—
The Wm. B. Pollock Co., Youngstown, O
Tin and Terne Plates—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.
Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Tool Steel—
C. H. Besly & Co., Chicago, Ill.
Brœburn Steel Co., Brœburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Tubes—
National Tube Works, McKeesport, Pa.
Shelby Steel Tube Co., Cleveland, O.
Tube Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Tube Welding—
S. Fix Sons, Cleveland, O.
Tumbling Mills—
The S. Obermayer Co., Cincinnati, O.
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.
Twist Drills—
C. H. Besly & Co., Chicago, Ill.
Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.
Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Manning, Maxwell & Moore, New York City.
James Bonar & Co , Pittsburg, Pa.
Ventilating Fans—
B. F. Sturtevant Co., Boston Mass.
Vises—
Massey Vise Co., Chicago, Ill.
Water Softening Plants—
We Fu Go Co., Cincinnati, O.
Wire Coating—
The Ironsides Company, Columbus, O.
Wire Filler—
The Ironsides Company, Columbus, O.
Wire Machinery—
The F. B. Shuster Co., New Haven, Conn.
S. W. Goodyear, Waterbury, Conn.
Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.
Wire Rope Coating —
The Ironsides Company, Columbus, O.
Wire Rope Filling—
The Ironsides Company, Columbus, O.
Wood Pulleys—
Dodge Mfg. Co., Mishawaka, Ind.
Wrought Pipe—
National Tube Works, McKeesport, Pa.

Alphabetical List of Advertisers.

The star (*) indicates that the adv. appears alternate weeks; the dagger (†) once a month; the double dagger (‡) once in three weeks; the parallel (‖) three times out of four.

	PAGE
Acme Malleable Iron Works	2
Ætna-Standard Iron & Steel Co	29
Ætna Fire Brick Co	32
Aitchison, Rob't, Perforated Metal Co	31
Allis & Co., Edward P	39
*American Pneumatic Tool Co	31
American Tin Plate Company	41
Apollo Iron & Steel Co	1
Armstrong Bros. Tool Co	1
Armstrong Mfg. Co	28
Aultman Co	2
Austin Separator Co	43
Bacon, Earle C	32
Baird Machinery Co	23
Baush & Harris Machine Tool Co	44
Becker, August	1
*Berger Mfg. Co	—
*Bertsch & Co	25
Besly & Co., Chas. H	44
Bethlehem Steel Co	43
*Bickford Drill & Tool Co	31
Bickford, H	44
Blakeslee Mfg. Co	1
Boettcher, A. F	33
Bonar & Co., James	27
Bourne-Fuller Co	1-2
Brœburn Steel Co	37
Brainard Milling Machine Co	25
Brass Founders' Supply Co	32
Brier Hill Iron & Coal Co	23
Bristol Co., The	1
Britton & Co., J. Blodgett	2
*Brown, Edward	—
Brown Hoisting and Conveying Machine Co	30
Bucyrus Co	30
Cahall Sales Department	1
Central Electrotype & Engraving Co	42
*Champion Rivet Co	—
Chicago Fire Clay Product Co	32
Chicago & Northwestern Ry.	35
Chicago Press Clipping Bureau	23
*Chicago Rawhide Mfg. Co	38
Chicago Screw Co	1
Clayton Air Compressor Works	2
Clearfield Fire Brick Co	32
Cleveland Ball & Screw Co	28
Cleveland City Forge & Iron Co	1
†Cleveland Facing Mill Co	—
Cleveland Rolling Mill Co	29
Cleveland Tool & Supply Co	26
Clinton Iron & Steel Co	29
Cleveland & Buffalo Transit Co	40
Cole, J. Wendell	44
Covert Mfg. Co	29
Cramp & Sons, Wm	40
Cremer & Bicknell	31
Crescent Steel Co	37
Danielson Machine & Tool Co	44
Davis Machine Co., W. P	26

Delano, E. A. 29
Detroit & Cleveland Navigation Co 28
Dickman & MacKenzie 2
Dixon Jos., Crucible Co. 40
*Dodge Mfg Co. —
Dover Fire Brick Co. 33
Drake, Bartow & Co. 29
Emmerton, P. A. 2
Enterprise Boiler Co. 1
Eriksen, Edward E. 23
Excelsior Iron Works Co. 30
Fitzsimons & Co. 37
*Fix Sons 33
Fleharty, J. H. & Co. 43
Forster, Waterbury & Co. 1
Fraser & Chalmers 25
Frick Coke Co., H. C. 1
Gandy Belting Co. 44
Garden City Sand Co. 32
Gerlach, Peter & Co. 37
Gobeille Pattern Co. 37
Goodyear, S. W. 28
Greenwald Co., I. & E. 27
Hall Steam Pump Co. 33
Hanna & Co., M. A. 29
Harrington & King Perforating Co. 1
Harrison Safety Boiler Works 21
Hartford Steam Boiler Insp. & Ins. Co. 28
Heyl & Patterson 30
Holmes, Strachan & Co. 32
Hooven, Owens & Rentschler Co. 27
Hunt Robt. W., & Co. 2
Illinois Central R. R. —
Ingersoll-Sergeant Drill Co. 2
Iron Clad Paint Co. 40
Ironsides Co. 22
Jeffrey Mfg. Co. 30
Jenkins Bros 40
Jones & Co., John T. 2
Jones Foundry & Machine Co., W. A. 1
Jones & Laughlins, Ltd. 41
King Improved Sand Blast Co. 29
Kentucky Fire Brick Works 23
Konigslow & Bro., E. 28
La Belle Steel Co 37
Lake Superior Consolidated Iron Mines 29
Lane & Bodley 39
Laughlin & Co., Alex 31
Lidgerwood Mfg Co. 30
Link-Belt Machinery Co. 30
Lorain Foundry Co 42
Lorain Steel Co. 41
Lusch, H. B. 43
Mason, Samuel R. 37
Main Belting Co. 38
Manning, Maxwell & Moore 24
Marion Steam Shovel Co. 44
McKeefrey & Co. 29
Meehan Boiler & Construction Co. 1
Merchant & Co. 38
Millers Falls Co. 44
Millett Core Oven Co. 3-32
Mitchell, Samuel 44
†Modern Machinery 31
Morris & Bailey Steel Co. 37
*National Engraving Co. —
National Tube Works Co. 43
†Newport Sand Bank Co. —
Northampton Emery Wheel Co. 38
Nuttall Co. The R. D. 27
Oak Hill Fire Brick & Coal Co. 23
Oglebay, Norton & Co. 29
†Ohio Sand Co. —
Ohio Steel Co. 29
Otis Steel Co. 22
†Parkhurst & Wilkinson Co. —
Perfect Lubricating Metal Co. 44
Phillips' Sons Co., P. R. 1-42
Phœnix Horse Shoe Co. 23
Pickands, Mather & Co. 29
Playford Stoker Co. 40
Pollock, The Wm. B. Co. 2
Prescott Steam Pump Co. 33
Q & C Co. 21
Rand Drill Co. 2
Reading Crane & Hoist Works 30
Riter-Conley Mfg. Co. 31
Riverside Foundry Co. 22
Robins Conveying Belt Co. 33
*Rockwell & Co., W. S. 25
Ryan, T. J. & Co. 33
Sanderson Bros. Steel Co. 37
Seaman, Sleeth Co. 42
Sennett Co., Geo. B. 39
Schwarzenberg, Henry L. 32
Scioto Star Fire Brick Works 32
‖Sharon Fire Brick Works 1
Sheater-Peters Paint Co. 24
Shelby Steel Tube Co. 2
Shiffler Bridge Co. 31
Shuster, The F. B., Co. 28
Skinner Chuck Co. 28
Smith & Co. A. F 29
Southwark Foundry and Machine Co. 39
Spearman Iron Co. 44
Sprocket Chain Mfg. Co. 22
Standard Paint Co. 23
Stevens, F. B. 26-44
Streeter, H. A. 2
Stroud & Co., E. H. 2
Sturtevant Co., B. F. 1-25
*Superior Charcoal Iron Co. —
Swarts Metal Refining Co. 1
Tabor Mfg Co. 32
Textor, O. 2
Tod, Wm. & Co. 39
Totten & Hogg Iron and Steel Foundry Co. 42
Union Mining Co. 22
Union Boiler Tube Cleaner Co. 1
United States Hotel Co. 40
Upson Nut Co. 1
Van Dorn & Dutton Co. 27
Vulcan Mfg. Co. 31
Washington Coal and Coke Co. 33
Western Mfg. Co. 1
Webster, Camp & Lane Machine Co. 23
Webster Fire Brick Co. 1
We Fu Go Co. 28
Wheeling Mold & Foundry Co. 44
White, Byron H. 37
Wyman & Gordon 43

BRÆBURN STEEL COMPANY, Bræburn, Pa.

MANUFACTURERS OF

FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

DIRECTORS: Wm. Metcalf, Chas. Metcalf, F. B. Hasbrouck, R. P. Kelly, Sec'y. and Treas.

MORE WEAR from your tools

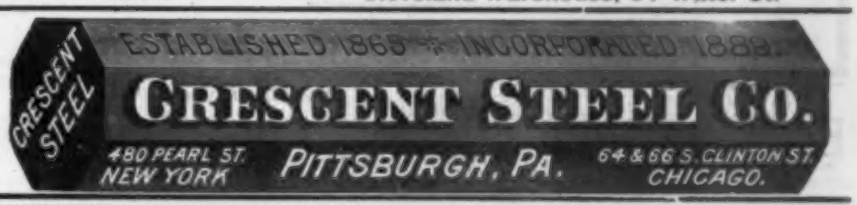
.....Almost no **STEEL EXPENSE**

NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL CO.

Cleveland Warehouse, 97 Water St.



La BELLE STEEL CO., Pittsburgh, Pa.

MANUFACTURERS OF FINE

CRUCIBLE CAST TOOL STEEL.

SPECIAL GRADES FOR ALL PURPOSES.

BYRON H. WHITE,

Western Selling Agent.

OFFICE AND WAREHOUSE: **68 and 70 South Canal St., Chicago.**

ECLIPSE
"ECLIPSE" COLD DRAWN
SHAFTING
FITZSIMONS & CO. CLEVELAND, OHIO
BYRON H. WHITE WESTERN SELLING AGENT
WAREHOUSE & OFFICE 68 – 70 SO. CANAL ST. CHICAGO

BYRON H. WHITE, Western Selling Agent,

68-70 South Canal St., Chicago.

THE MORRIS & BAILEY STEEL CO.
COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING DRAWING BLANKING SPRINGS ETC
BYRON H WHITE
PITTSBURG, PA.

BYRON H. WHITE, Western Selling Agent, CHICAGO.

Don't Waste Money in Your Pattern Shop.

THE GOBEILLE PATTERN CO., Cleveland.

FOUR-NIGHT.

Cleveland Union Station.

Pennsylvania Lines.

Foot of Bank Street.

TICKET OFFICES at Station, Euclid Av., Woodland Av., and Weddell House corner.

THROUGH TRAINS RUN AS FOLLOWS BY CENTRAL TIME

*Daily. †Daily except Sunday.

xDaily except Saturday. ‡Saturdays only.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	† 3:15 pm	† 6:25 pm
Philadelphia and New York	* 2:10 pm	*11:30 am
Baltimore and Washington	* 2:10 pm	*11:30 am
Alliance and Pittsburgh	* 2:10 pm	*11:30 am
Ravenna and Alliance	* 5:00 pm	* 8:45 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
Alliance and Pittsburgh	*11:10 pm	* 4:30 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Columbus and Cincinnati	* 8:35 am	* 5:40 pm
Indianapolis and St. L.	* 8:35 am	* 5:40 pm
Millersburg and Akron	† 3:15 pm	†12:10 pm
Col., Cin., Ind. & St. L.	x7:40 pm	*7:30 am

SAMUEL R. Mason ENGRAVING AND ELECTRO-TYPING

CLEVELAND

We are particularly adept in mechanical wood engraving. Also make a specialty of fine half-tone photo engraving. Should be pleased to mail examples of our work on request.

PETER GERLACH & CO.,

MAKERS OF

Saws Tools and Machinery.

Office and Warerooms, 28 Columbus St.

Factories on Columbus, Winter and Leonard Sts.

Cleveland, Ohio U. S. A.

BABBITT METALS

All standard and special grades.
In sectional molds or bars.

Phila. Chicago. **MERCHANT & CO., Inc.** New York. Brooklyn

Wrtte us for prices always. It will pay you.

Eddy Dynamo Electro-Plating Machines

— FOR —

BICYCLE PLATING PLANTS.

NORTHAMPTON EMERY WHEEL CO., 20 S. Canal St., Chicago, Ill.

EXCLUSIVE WESTERN SELLING AGENTS.

Leviathan Belting.

Tested under the hardest possible conditions and proved by years of service to be the best belt

For Heavy Driving of All Kinds.

Proof against Heat Steam and Water.
Strength Durability, and Traction Power Unequalled.

SOLE MANUFACTURERS,

MAIN BELTING CO.

1219-1235 Carpenter St., PHILADELPHIA.
55 and 57 Market St., CHICAGO.
120 Pearl St., BOSTON.

Send for Price Lists and Sam ples

RAWHIDE BELTING

And Lace Leather.

— ALSO —

Rawhide Rope, Pinions, Picker Leather, Halters, Bell and Register Cord, and other Rawhide Goods of all kinds.

THE MABBS HYDRAULIC RAWHIDE PACKING.

CHICAGO RAWHIDE MFG. CO., 75-77 Ohio St., CHICAGO, ILL.

Advertisers who "keep everlastingly at it" win success.
That is the testimony of the shrewdest and livest of them.

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie Docks.]

Special low-phosphorous hard ore, Bessemer	$4 30
No. 1 Specular, Bessemer	$3.50@ 4.25
No. 1 Bessemer, hem tite	3.00@ 4 05
Hematites No. 1 n n-Bessemer	2.25@ 2 70
No. 1 Specular, non-Bessemer	2.50@ .75
Mesabi Bessemer	2.50@ .00

PIG IRON.

Cleveland (f. o. b. cars):

Bessemer	$18.65
No 1 Strong Foundry	$17 75@ 18.75
N . 2 Strong Foundry	17.25@ 18 25
Gray Fo ge red short	16 00@ 16.50
No. 1 American Scotch	1 .75@ 18.75
No 2 American Scotch	17.50@ 18.50
Lake Superior Charcoal	19.00@ 20.00

OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons.
Old iron rails	$20 00
Old steel rails (6 ft. and over)	15.00
Old steel rails (6 ft. and under)	15.00
Old car wheels	16.00
	Net Tons.
No. 1 R. R. wrought scrap	$16.50
Mill scrap	11 50
No 1 Ma hin- cast scrap	13.00
Iron axles	19 00
Axle turnings	11.00
Wrought turnings (free from cast)	10.00
Cast borings	9.00
Uncut wrought iron boilers	7 00
Steel boiler plates	11.00
Grate bars	8 00
Pipes and flues (clean)	10.00
Tank Iron	12,00
Hoop and band iron	9.00
Sheet iron	8.00
Wrought drillings	10.00
Malleable iron	10.50

STRUCTURAL MATERIAL.

Beams and channels (f. o. b. Cleveland)	1.85c
Angles	1.85@ 1.95c
Tees	1.90c
Universal plates	2.25@ 2.50c
Sheared plates	2 40c

MERCHANT IRON & STEEL

[Less than car-lots, Cleveland.]

Rounds and Squares—Bar Iron.

1 to 1⅞	1.85 Base.
2 to 2¾	.20 extra.
3 to 3½	.50 "
3⅝ to 4	.80 "
4⅛ to 4¼	1.00 "
4⅜ to 5	1.30 "
5⅛ to 6	1.70 "
6⅛ to 6½	2.20 "
6⅞ to 7⅛	2.50 "
¾ to ⅞	.10 "
⅝ to 11-16	.20 "
½ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 1-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.05 Base
4¼ o 6 x ⅜ to 1	.10 extra
6¼ o 8 x ⅜ to 1	.60 "
8¼ o 10 x ⅜ to 1	.80 "
1¼ o 4 x 1 1-16 to 1⅜	.30 "
4¼ to 6 x 1 1-16 to 1⅜	.40 "
6¼ to 8 x 1 1-16 to 1⅜	.60 "
8¼ to 10 x 1 1-16 to 1⅜	.90 "
2 to 4 x 1⅜ to 2	.50 "
4¼ to 6 x 1⅜ to 2	.60 "
6¼ to 8 x 1⅜ to 2	.80 "
8¼ to 10 x 1⅜ to 2	1.00 "
2 to 4 x 2⅜ to 3	.60 "
4¼ to 6 x 2⅜ to 3	.80 "
6¼ to 8 x 2⅜ to 3	1.00 "
1¼ to 1⅜ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅞	.20 "
¼ to 15-16 x ⅜ to ⅞	.40 "
⅝ to 11-16 x ⅜ to ⅞	.50 "
½ to 9-16 x ⅜ to ⅞	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1¼ to 4 x ¼ to 5-16	.20 "
1 to 1¾ x ¼ to 5-16	.30 "
¼ to 15-16 x ¼ to 5-16	.50 "
⅝ to 11-16 x ¼ to 5-16	.80 "
½ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

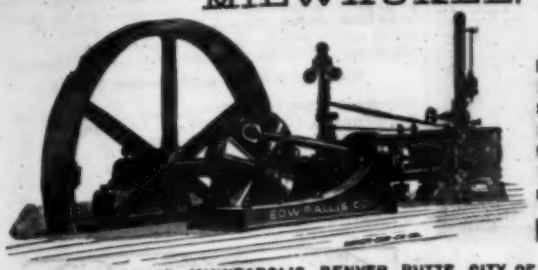
Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. **Bevel Edge Shaft Iron** 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



MANUFACTURERS OF

Blowing Engines, Hoisting Engines, Pumping Engines Air Compressors, Special Engines for Electric Lighting Street Railways and Rolling Mills. Ore Crushers, Crushing Rolls, Stamp Mills Concentrators, General Mining Milling and Smelting Machinery.

Reynolds Corliss Engines.

NEW YORK. CHICAGO. MINNEAPOLIS. DENVER. BUTTE. CITY OF MEXICO. SAN FRANCISCO. PITTSBURG

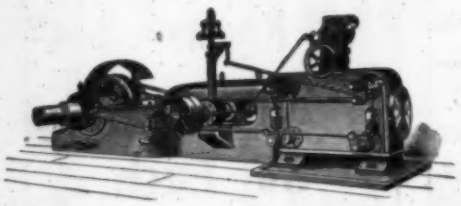
Southwark Foundry & Machine Co.

PHILADELPHIA, PA.

Porter-Allen Automatic Engines,
Blowing Engines, Centrifugal Pumps,
Weiss Counter-Current Condensers.

THE LANE & BODLEY CO.,

CINCINNATI, OHIO.



Engines,

ALL SIZES.

Simple and Compound.

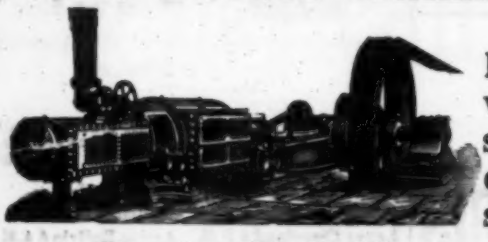
Shafting, Hangers, Pullevs.

Belt Elevators, Saw Mills.

WILLIAM TOD & CO.

YOUNGSTOWN, OHIO.

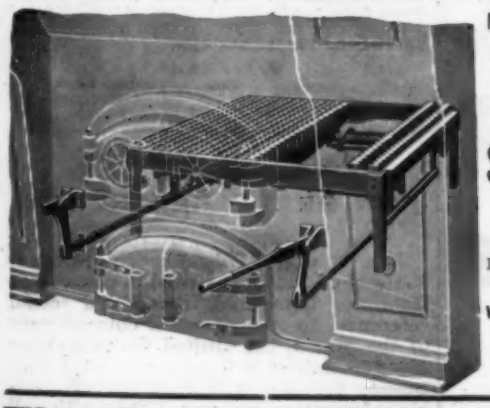
The Porter-Hamilton Engine



Reversing Engines, Blowing Engines, Converters, Hydraulic and special heavy machinery for the iron and steel trades.

Park Building, Pittsburg.

SEWARD S. BABBITT.



The Geo. B. Sennett Co.,

YOUNGSTOWN, OHIO.

Manufacturers of the

SENNETT ROCKING GRATE.

Economy of Fuel
Economy of Time.

Prevents large clinkers. Convenient and Substantial. Apply for circulars.

We make also SENNETT ENGINE, 20 to 40 H. P
SENNETT COMPRESSION COUPLING
and CASTINGS to 5 tons each.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year **$3.00.**

7-16 to ½ x No. 9 to 3-16	1.50 extra
7-16 to ½ x Nos. 10, 11 and 12	1.40
½ x No. 9 to 3-16	1.50
½ x Nos. 10, 11 and 12	1.40

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1¼	.40 extra
⅜ to 13-16	.30 "
⅜ to 11-16	.20 "
⅜ to 9-16	.80 "
⅜ to 7-16	1.10 "
½ to 9-16 x 3-16	1.00 "
½ to 11-16 x ⅜	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra
⅜ to 2	.50 "
⅜ to 13-16	.70 "
⅜ to 11-16	.90 "
½ to 9-16	1.20 "
½ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness extra price.

Horse Shoe Iron.

All sizes.....1 c. extra.

Cutting ordinary bars to specified length, .20 to .30 extra, according to length and size.

Steel Bands.

Width In Inches.	English Standard Gauge.		Extras.
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16"	1.50 Base.	
1¼ to 6,	" 10, 11, 12 or ¼"	.05	per 100 lbs
1 to 1¼,	" 7, 8, 9 or 3-16"	.10	"
1 to 1¼,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½, Nos. 7, 8, 9 or 3-16"		.55	"
½, " 10, 11, 12 or ¼"		.60	"
7-16 " 7, 8, 9 or 3-16"		.75	"
7-16 " 10, 11, 12 or ¼"		.85	"
⅜, " 7, 8, 9 or 3-16"		.95	"
⅜, " 10, 11, 12 or ¼"		1.05	

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		Extras.
7-16 to 3	Nos. 13, 14, 15 and 16	1.60 Base	
7-16 to 2,	" 17, 18, and 19	.25	per 100 lbs
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1¾,	" 22	.25	"
¼ to 1¾,	" 13, 14 and 15	.25	"
½ to ⅞	" 16, 17 and 18	.15	"
1¼ to 1¾,	" 19 and 20		per 100 lbs.
1¼ to 1¾,	" 21	.20	"
1¼ to 1¾,	" 22	.30	"
15-16 and 1,	" 13, 14 and 15		"
15-16 and 1,	" 16, 17 and 18	.15	"
15-16 and 1,	" 19 and 20	.20	"
15-16 and 1,	" 21	.25	"
15-16 and 1,	" 22	.35	"
⅞, Nos. 13, 14 and 15		.20	"
⅞, " 16, 17 and 18		.25	"
⅞, " 19 and 20		.30	"
⅞, " 21		.35	"
⅞, " 22		.45	"
¾ and 13-16 Nos. 13, 14 and 15		.30	"
¾ and 13-16 " 16, 17 and 18		.35	"
¾ and 13-16 " 19 and 20		.40	"
¾ and 13-16 " 21		.45	"
¾ and 13-16 " 22		.50	"
¾ and 13-16 " 23		.60	"
11-16, Nos. 13, 14 and 15		.35	"
11-16, " 16, 17 and 18		.40	"
11-16, " 19 and 20		.50	"
11-16, " 21		.60	"
11-16, " 22		.70	"
11-16, " 23		.80	"
⅝, Nos. 13, 14 and 15		.40	"
⅝, " 16, 17 and 18		.45	"
⅝, " 19 and 20		.55	"
⅝, " 21		.65	"
⅝, " 22		.75	"
⅝, " 23		.85	"
9-16, " 13, 14 and 15		.45	"
9-16, " 16, 17 and 18		.50	
9-16, " 19 and 20		.60	
9-16, " 21		.70	
9-16, " 22		.80	
9-16, " 23		.90	
½, " 13, 14 and 15		.53	
½, " 16, 17 and 18		.60	
½, " 19 and 20		.70	
½, " 21		.80	
½, " 22		.90	"
½, " 23		1.00	"
7-16, " 13, 14 and 15		.80	"
7-16, " 16, 17 and 18		.90	"
7-16, " 19 and 20		1.00	"
⅜, " 13, 14 and 15		1.00	"
⅜, " 16, 17 and 18		1.10	"
⅜, " 19 and 20		1.20	"

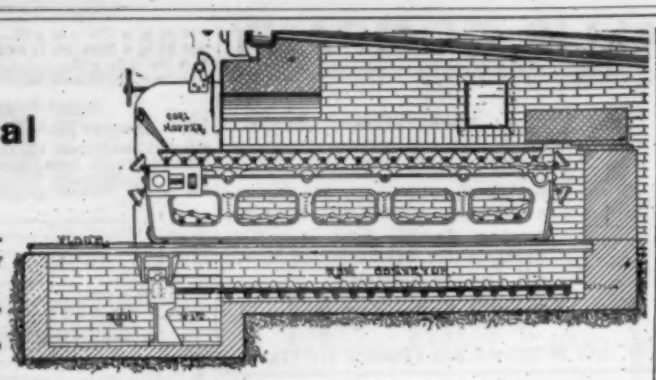
Sheet Iron.

No. 10	2 35
No. 12	2 35
No. 14	2 45
No. 15-17	2 50
No. 18	2 65
No. 20	2 80
No. 22-24	2 85
No. 25-26	3 00
No. 27	3 30

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 50
Shell	2 60
Flange	2 75

The Playford Mechanical Stoker



Guaranteed to
Abolish smoke, to increase boiler capacity and to save fuel.
For information, address,
The Playford Stoker Co.
404 Telephone Bldg.,
CLEVELAND, OHIO.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND, OHIO.

ORDER DIRECT FROM THE
Iron Clad Paint Co.
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.
IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.
FURNISHED both Dry and Ground in Oil
USED BY NEARLY ALL THE RAILROADS.

COMPARE WEIGHTS

WHEN YOU ARE TOLD THAT JENKINS '96 IS MORE EXPENSIVE THAN OTHER PACKINGS.
Average weight, ¼" "Jenkins '96." 11 lbs. to the square yard.
" " ¼" Red Packing, 14 " " " "
At 50c. per pound "JENKINS '96" is not only very much cheaper, but the best joint packing manufactured.
JENKINS BROS., New York, Boston, Philadelphia, Chicago

Dixon's Pure Flake Graphite

Is a Blessing to Every Engine Room and Machine Shop.
A small quantity added to any Oil or Grease largely increases its lubricating value and makes the finest Cooling Mixture.
Pamphlet and Sample Sent Free.
JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

FOR GREAT TENSILE STRENGTH, ELASTICITY AND ELONGATION, COUPLED WITH UNUSUAL NON-CORROSIVE QUALITIES,

Castings and Propeller Wheels

MADE FROM

PARSONS MANGANESE BRONZE

CANNOT BE EXCELLED. WRITE FOR PARTICULARS.

SOLE MAKERS,

THE WILLIAM CRAMP & SONS

Ship and Engine Building Company,

PHILADELPHIA, PA.

A paper that is paid for and read—THE IRON TRADE REVIEW.

Marine Flange	3 00
Fire Box	3¼
Above includes plates 90 inches wide.	
90 to 96 in. wide	..1c. lb. extra
96 to 100 in. wide	1½c. "
100 to 104 in. wide	2c. "
104 to 108 in. wide	special

Wrought Pipe and Boiler Tubes.

Merchant pipe, from store	dis. 50 and	10
Boiler tubes, 1¼ to 1½ inch	Discount	35
" " 1¾ to 2½ inch, iron,	"	35
" " " " steel,	"	45
" " 2¾ to 4 inch, iron,	"	50
" " " " steel,	"	50
Casing, screw and socket joint	"	53⅓
Casing, inserted joint	"	45
	"	35

Weddell House

Cleveland, Ohio.

THE U.S. HOTEL CO.
C.A. SWAN & W.L. BATES
MANAGERS

50 ROOMS AT 2.00
50 ROOMS AT 2.50
75 ROOMS AT 3 TO 4.00
All Meals 50¢ Each

C & B LINE

CLEVELAND TO BUFFALO
"While you Sleep"

UNPARALLELED NIGHT SERVICE. NEW STEAMERS
"CITY OF BUFFALO"
AND
"CITY OF ERIE."
both together being without doubt, in all respects, the finest and fastest that are run in the interest of the traveling public in the United States.

TIME CARD,
DAILY INCLUDING SUNDAY.
Leave Cleveland 8 P.M. Arrive Buffalo 6 A.M.
" Buffalo 8 " " Cleveland 6 "
CENTRAL STANDARD TIME.

Connections made at Buffalo with trains for all Eastern and Canadian points. Ask ticket agent for tickets via C. & B. Line. Send four cents for illustrated pamphlet. SPECIAL LOW RATES TO BUFFALO AND NIAGARA FALLS EVERY SATURDAY NIGHT.

W. F. HERMAN,
General Passenger Agent,
CLEVELAND, O.

MAPS
FOR READY REFERENCE.

The Chicago, Milwaukee & St. Paul Railway Co. has just issued in conveniens form, for household, library and school reference, an atlas of seven colored maps of the world, the United States and our new possessions in the Atlantic and Pacific Oceans, together with an amount of valuable information connected therewith—all up to date. This atlas will be sent free to any address on receipt of six (6) cents in postage.

Apply to Geo. H. Heafford, General Passenger Agent, Old Colony Bldg., Chicago

JONES & LAUGHLINS, Limited,

PITTSBURG, PA.

Branch House, CHICAGO, ILL. Branch Office, 220 Broadway, NEW YORK.

MANUFACTURERS OF

Proof-Crane and Cable **CHAINS** Of Superior Quality.

Every Chain tested and proof certificate furnished whenever desired.

THE

LORAIN STEEL COMPANY,

Lorain, Ohio.

Rails, Blooms, Billets and Slabs.

American Tin Plate Company

MANUFACTURERS OF

Coke Tin Plates,

Charcoal Tin Plates,

High Grade Terne Plates,

Black Plates.

GENERAL OFFICES:

Marquette Building.

CHICAGO, ILL.

Tin Plate Mills and Machinery

ROLLING MILL MACHINERY, CHILLED AND SAND ROLLS.

"ZERO" Highest grade Anti-Friction Metal. Estimates given on complete plants.

F. R. PHILLIPS' SONS CO., 18 So. Broad St., PHILADELPHIA.

THE LORAIN FOUNDRY COMPANY,

Lorain, Ohio.

SAND AND CHILLED ROLLS.

Heavy Iron Castings in Loam, Dry and Green Sand, Made from Cupola or Air Furnace...

BRASS AND COPPER CASTINGS.

Cleveland, Cincinnati, Chicago & St. Louis Railway.

—BIG FOUR ROUTE.—

Solid vestibuled trains run daily to Columbus, Dayton, Cincinnati, Indianapolis, St. Louis. Parlor car and Wagner Sleeping cars. Best line in the West, South and Southwest. Ticket office 116 Euclid ave, Bell Tel. Main 910. Home Tel. 853.

		Depart.
No. 11,	Southwestern Limited	*3:30 am
No. 3,	Columbus & Cincinnati Ex	7:15 am
No. 25,	Wellington Ac. (Sun. only)	8:30 am
No. 33,	Columbus & Cincinnati Ex	*11:40 am
No. 35.	Ind. & St. Louis Express	*12:00 m
No. 27,	Columbus Accom	4:00 pm
No. 37,	Col., Cin. Express	*8:30 pm
		Arrive.
No. 28,	Cin. & Col. Express	*6:45 am
No. 26,	Calion Accommodation	9:45 am
No. 36,	Indianapolis & St. L. Ex	*2:30 pm
No: 46,	Columbus & Cin. Express	*2:55 pm
No. 24,	Wellington Accom	*6:25 pm
No. 2.	Col., Cin. & Ind. Ex	9:25 pm
No. 18,	Southwestern Limited	*1:50 am

*Daily.

Nos. 11 and 13 do not stop at the Erie Ry. depot. No. 37, leaving at 8:30 pm. has local sleeper for Cincinnati. Nos. 33 and 46 have dining cars.

For tickets call on D. JAY COLLVER, City passenger and ticket agent. No. 116 Euclid av. (Colonial Arcade), Cleveland, O.

WARREN J. LYNCH,
G. P. and T. A. Cincinnati, O.

MONON ROUTE
CHICAGO, INDIANAPOLIS & LOUISVILLE RAILWAY

THE

DIRECT LINE

BETWEEN

Chicago . .
Indianapolis
Cincinnati .
Lafayette . .
Louisville . .

AND ALL POINTS

SOUTH

For time table and other information, address

FRANK J. REED, General Passenger Ag't,
CHICAGO.

FOR SALE.

SECOND-HAND TOOLS.

(2) Sheet Iron Shears; (1) Lever Punch; New 12' Bending Roll; 10' Power Squaring Shear: 6' Cornice Clamp; 37' Sheet Iron Roll.

BERTSCH & CO.,
Cambridge City, Ind.

"It is true that advertising will not put merit into poor merchandise, but good merchandise often becomes poor for the want of good advertising."

—*Some Essential Oils for Advertisers*

The Chemical Analysis of Iron.

A Complete Account of all the best-known Methods for the Analysis of Iron, Steel, Pig Iron, Iron Ore, Lime-stone, Slag, Clay, Sand, Coal, Coke, and Furnace and Producer Gas. By ANDREW ALEXANDER BLAIR. New (Third) Edition. Illustrated. 8vo. Half Morocco, $4.

The reputation which this book has won for itself in the estimation of analytical chemists will be increased by the many improvements in the Third Edition

Sent postpaid on receipt of price by

THE IRON TRADE REVIEW CO.,
27 Vincent St., Cleveland, O.

The Cleveland Terminal & Valley R. R. Co

(B. & O. System.)

Depot foot of So. Water St. City Office 241 Superior St.	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:25 P M	*7:25 A M
Wheeling & Chicago	*9:25 P M	†7:35 A M
Akron, Canton & Chicago	*8:05 A M	*10:00 P M
Akron, Canton & Wheeling	*10:20 A M	*3:30 P M
Akron, Canton & Chicago	*8:05 A M	*8:35 P M
Akron, Canton & Marietta	†2:10 P M	†11:00 A M
Pittsburg, Washington D C, & Baltimore	*10:30 A M	*3:25 P M

†Daily except Sunday *Daily. Pullman's Palace Vestibule sleeping cars between Cleveland and Chicago, also Washington, Balto and Philadelphia.

THE CENTRAL ELECTROTYPE AND ENGRAVING CO.
263-271 St. Clair St. Cleveland O
WOOD ENGRAVING
ELECTROTYPING.

Larger paid circulation and larger list of advertising patrons than ever in its history. These THE IRON TRADE REVIEW now has. Advertising in it pays.

WEST AND SOUTH

run the lines of the Illinois Central Railroad and the Yazoo & Mississippi Valley Railroad, reaching into the eleven States of

South Dakota	Kentucky
Minnesota	Tennessee
Iowa	Arkansas
Wisconsin	Mississippi
Illinois Indiana	Louisiana

Presenting an unequaled territory for diversified industries, and possessing

Fine Sites for New Mills

Best of Freight Facilities,—Coal Fields,

Close Proximity to Distributing Centers,

Intelligent Help of All Kinds,

Many Kinds of Raw Material.

To sound industries, substantial inducements will be given by many of the places concisely described in the pamphlet "100 Cities and Towns Wanting Industries." Write for a copy. Nearly all kinds of industries are wanted. Very liberal inducements are offered TEXTILE INDUSTRIES in the South by a number of good places. GEORGE C. POWER, Industrial Commissioner I. C. R. R. Co., Chicago. I. 2-98.

Steel Stamps and Stencils.

FLEHARTY, J. H. & CO., Rubber Stamps, Seals, Stencils, Automatic Check Punches, Numbering Machines. 92 Seneca street.

J. M. ALLEN, President.

WM. B. FRANKLIN, Vice-President.

F. B. ALLEN, Second Vice-President.

J. B. PIERCE, Secretary and Treas.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

BURWELL & BRIGGS, General Agents, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

C. A. BURWELL, Chief Inspector, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

J. E. WOLCOTT, Special Agent, 32 and 33 Clark Bldg., 208 Superior St., Cleveland, O.

Largest Dimensions. Highest Quality.

STEEL CASTINGS.

We are thoroughly equipped to meet all Specifications.

CORRESPONDENCE SOLICITED.

BETHLEHEM STEEL COMPANY,

South Bethlehem, Penn'a.

BRANCH OFFICES:
100 Broadway, New York. 421 Chestnut St. Phila. 1433 Marquette Bld'g, Chicago.

National Tube Works Company,

MILLS AT McKEESPORT, PA.

The largest makers of Special Mild Steel and Wrought Iron Pipe, Boiler Tubes and Casing in the World. From ore to finished product. Sizes from ⅛ of an inch to 30 inches.

SALES HOUSES:

Pittsburg, Chicago, St. Louis, New York, Boston.

Hydraulic Pressed Forging.

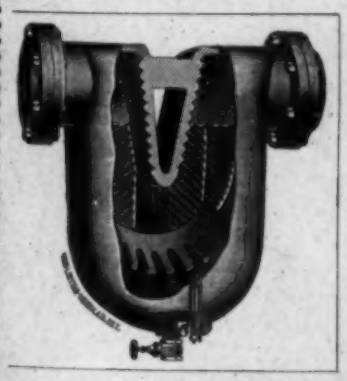
WYMAN & GORDON, Worcester, Mass.
New York Office: 116 Liberty st.

DROP FORGINGS.

The A B C of Iron.—A book for foundrymen. It is issued in cloth binding, and gives much valuable matter on how to reduce cost of mixtures, and on grading and numbering of pig iron. CHAPTER HEADINGS:—Iron—What is it? Pig Iron. Constituents of Iron. Numbering of Pig Iron. Grading of Iron. How to Reduce Cost of Mixture. Steel. Physical Properties of Metals Defined. Statistics. Early History and Manufacture of Iron. Former price $2.00, NOW $1.00. Order of *The Iron Trade Review Co.*, 27 Vincent St., Cleveland, O.

97 PER CENT DRY STEAM.

52 PER CENT PURE OIL.



F. L. Emory's test of a Steam Separator, as read before the American Association of Mechanical Engineers at the May meeting, was made on a Horizontal . . . . .

AUSTIN SEPARATOR.

Ninety-seven per cent dry steam can be obtained from nearly any one of the thousands of AUSTIN SEPARATORS now in commission, and 52 per cent of pure oil saved from Exhaust is really below the record of our machines in regular service.

AUSTIN SEPARATOR COMPANY,

18-23 Woodbridge St., Detroit, Mich.

30 Days Trial Free. Write for Catalogue.

PIG IRON

Spearman Iron Company,

Sharpsville, Pa.

Inspected Foundry Irons. Softness, Strength, Fluidity, Uniformity.

American Scotch
brand unequaled.

HENDERSON & TRAGO, Agents,
CLEVELAND, O.

Absolutely without a rival.

Perfect Lubricating Metal.

The only Phosphorized Tin Graphite Bearing Metal in the world. Write for particulars. Ask your dealers for it.

Perfect Lubricating Metal Co.,
Second and Plum Sts.,
Cincinnati, Ohio, U. S. A.

No. 18 to 21 New Pattern Presses.

DANIELSON MACHINE AND TOOL COMPANY,

MANUFACTURERS OF AND DEALERS IN

Machine Tools

Dies, Special Machinery, Etc.

AGENTS for E. W. Bliss Co.'s and Garvin Machine Co.'s full line of

Presses and Machine Tools.

Address

83-87 Lake St.,
CLEVELAND, O.

X LOOK! STOP! LISTEN!

That Foreign Machine Works are preparing to meet American competition is shown by the number of recent orders for

THE SELLER'S TOOL GRINDERS and DRILL GRINDERS.

"A word to the wise is sufficient." Write to

J. WENDELL COLE, District Manager,
DETROIT EMERY WHEEL CO.,
P. O. Box 486, CHICAGO. P. O. Box 84, COLUMBUS, O.,
For "Some Points about Grinding Tools."

Radial Drills,

FOR EVERY CLASS OF WORK. 1899 Catalog Describes Them.

BAUSH & HARRIS MACHINE TOOL CO.,
Springfield, Mass., U. S. A.

SALES AGENTS:
MANNING, MAXWELL & MOORE,
New York, Chicago, Pittsburg, and Cleveland.
HILL, CLARK & CO.,
Boston.

EUROPEAN AGENTS:
SELIG SONNENTHAL & CO.,
London, E. C.
E. SONNENTHAL, Jr.,
Berlin, Germany.

Meehan Boiler & Construction Co.,

LOWELLVILLE, OHIO,

MANUFACTURERS OF

MEEHAN'S COMBINED SAFETY and WATER TUBE BOILER.
All kinds of Blast Furnace, Steel Plants and Stand Pipe Work.
Also all kinds of Oil Refinery and Tank Work.
WROUGHT IRON WELDED and RIVETED ANNEALING BOXES.
Structural and Engineering Work.

The "ORIGINAL GANDY"

Stitched Cotton Duck Belting,

Especially adapted for Main Drivers, Saw Mills, Cotton Gins, Cotton Presses, and for all places where belts are subjected to moisture or atmospheric changes, the "GANDY" stands paramount.

For farther information, prices, etc., write

The GANDY BELTING CO., Baltimore, Md.

Steam Shovels

FOR

Iron Mining.

We have machines of new designs with hoisting, swinging and crane engines. These were designed and constructed especially to meet requirements of iron mining and coal mining fields.

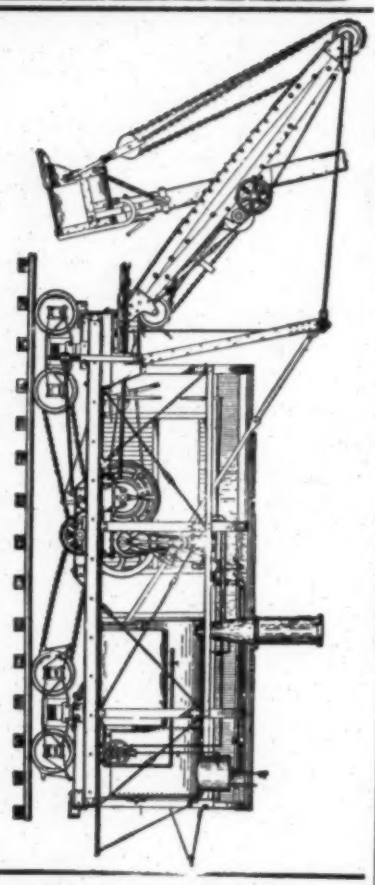
WE INVITE MOST RIGID INVESTIGATION.

For full information address

THE

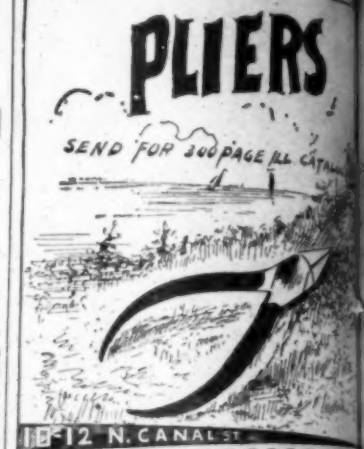
MARION STEAM SHOVEL CO.

Marion, Ohio.



When writing to advertisers please mention The Iron Trade Review.

PLIERS



18-12 N. CANAL ST.
C.H.BESLY & CO
CHICAGO, ILL. U.S.A.
FINE TOOLS & MFRS HARDWARE

The STAR Hack Saw Machine

FOR CUTTING METALS of all kinds up to 4½ inches in diameter. Several thousands are now in use and not one report has reached us that has not been complimentary. They are automatic, stopping themselves when cut has been made and no further attention is required than to adjust the work at the vise. A man at work on some other machine usually attends to this. No shop can afford to be without one or more. They will save their cost over and over again. **Price $45.00.**

Millers Falls Co., 93 Reade St., New York.

BORING AND TURNING MILLS,
4, 5 & 6 ft. Swing.
H. Bickford,
Lakeport,
N. H.

Write for Photograph and Low Prices.

Fire Brick, Fire Clay, Pig Iron
F. B. STEVENS, Detroit, Mich.

Special Machinery

IRON CASTINGS.

Estimates made from drawings. Working drawings prepared.

Wheeling Mold & Foundry Co.
Wheeling, W. Va.

When writing to advertisers please mention The Iron Trade Review.

VERMILION PINE & IRON LAND CO.
13,000 Acres of Mineral Land.
Situated on the Mesabi and Vermilion Iron ranges in Minnesota.

FOR SALE OR LEASE.
on favorable terms. Correspondence solicited.
Address **SAMUEL MITCHELL,**
Negaunee, Mich.

The consolidated Iron Trade Review and Industrial World, the leading Machinery, Foundry and Iron and Steel paper west of New York City.